branch - erotic branch. The earliest compositions
the religious branch are to be found in the Atharvaveda
in the मन्त्र of the अथर्ववेद, songs & magic spells
and exorcising charms. But in no way do they disclose
a decayed state of society overcome by superstitious fear
with ref. to these hymns a remark was made
by Weber - the hymns are no longer the expression
of direct religious emotion. They are simply clothed
in that form. This is inconsistent on the face of it,
if there has been no sincerity there would have been
no necessity for these incantations. Sincerity is pre-
sent in the environments of the Atharvaveda.
They were using them because they were efficacious,
one very fact that they were customary and main-
tained them as a standing monument is an unmista-
kable evidence of their sincerity in regard to
religious fervour.

Next to that, Mythics & the Rituals observed
in the practice, in case of particular deities or
goddesses as the occasion demands. In the Tantra
literature, they find their classical expression.
(Pancha Tantra). Due to the development of such lit. the following
considerations are supposed to have given rise to the
necessary incentive to make Sanskrit a spoken
tongue in its original purity. They
were: (1) to seek no favour of anyone,
it was felt necessary to repeat in this place a
many hints & as possible

[redacted] minded men, charitableness and the virtues
which now it strike case. If you go to any one for your
business, you will preface it by referring to his noble
character. The 108 named प्रभो- अष्टोत्तरशत-
नामावली, सहस्रनामावली form a class by themselves
रुद्राक्षमाला अष्टोत्तरशतकोटि.. with 1008 a crore times
the image in amulet form रक्षा - to remove
any evil influences - दीक्षाक्षर inscribed on a metal
plate and tied and worn round the neck. To this
apotropaic virtue is ascribed and it maintains
its efficacy even today.

The modern forms of these religious hymns are सोत्र
composed by kabirs & Shankara, and भक्तिगीत
devotional in the 20th and 21st. but some
have also. Besides the philosophical ideas
ideas flowing through them, they contain true
of aesthetic art and are composed in elegant
and dramatic

4th. (The erotic branch)
The earliest lyric poet known by tradition is Kaviraja
whose lyrical work is the Rāghavapāṇḍavīya of about 100 stanzas
Yaksa is separated by a curse from his wife. addresses the
cloud as a friend. work described very graphically. Poe
gave much scope for manifestation of heart. model for
later imitations
Śyāmalādaṇḍaka - a panegyric addressed to Saraswa
attributed to him.

Śṛṅgāra Tilaka - 25 verses.

Kākośa kāvya - a descriptive address of a lover to his beloved
barely of 20 verses. The style cannot be Kālidāsa's.

Ṛtusaṁhāra - Kālidāsa's. Glowing descriptions of nature and
seasons with erotic sentiments interspersed. No other work reveals
his deep sympathy with nature & his powers of describing it.

Nalodaya - a poem in 4 cantos - not attributed to Kālidāsa
The chief aim is to show off skill in the construction of all metres
and other things - purely artificial - Style speaks against Kālidāsa's
authorship.

Ghaṭakarpara - one of the nine gems of Vikrama's Court - His
small poem extremely artificial. यमक employed didactic
poem - most of the verses insipid and amusing. Free
flow of language impeded by यमक.

Bhartṛhari - tradition makes him an elder brother of Vikrama
of Ujjayini. great grammarian. Vākyapadīya & Śāra 2
standard works of in Grammar. In the lyrical field his fame
stands on his 3 Śatakas. They are collection of verses fit to
be an instructive primer for a beginner - not much of
poetic beauty - but some stanzas noted for their lyrical
harmony.

8th. Tradition makes him a contemporary of Śaṅkara.
His poem in prose & verse known as पञ्चस्तवी consists
of 5 century verses which are highly devotional and distinguished
by fine melody and rhythm. Tradition assigns him
to the 8th Century. Style compares favourably with Śaṅkara's
lyrical panegyrics. Vocabulary & diction.

Śaṅkara 8th century - apart from his eminent activities
in Vedānta, his fame as a lyrical poet - rests on the following
- प्रपञ्चसार द्वादश हरि. शत श्लोकी describes Śiva, सौन्दर्य-
लहरी, Lord Kṛṣṇa, Lord Śiva Pārvatī. शिव भुजङ्ग स्तोत्र - 37
verses of the भुजङ्ग प्रयात metre in praise of Śiva.

[redacted] language everywhere musical. Bhakti is transcendent and
overcoming throughout.
Bhallata-Śataka called after him resembles the Nīti-
Śataka of Bhartṛhari. Inanimate objects are addressed
with instruction in morals. Quoted by Kṣemendra & Abhinava
in 8th century. Verse strained but ideas fine & poetic.
Āryā Śataka attributed to Āryā. Rhythmical
tradition this poem was attributed to Śaṅkara who
transmigrated into the body of dead Āryā.
Quoted by Ānandavardhana who flourished in 9th
century. Tradition also shows that they were almost
contemporaries.
महाभारत - A Brahmin of Southern India, by divine
gift composed Hari Vilāsa. Kṛṣṇa's advent to Vraja
house to the message of Uddhava.
-Poetry - (Bhoja) - 10th century
Jayadeva - Gīta Govinda - about 1116 A.D. - the end of 11th
century & initial part of the 12th century. 12 sargas
and each contains 24 प्रबन्धs. a chorus follows
by 8 feet, chorus repeated. Work noteworthy 9 or
of the few come down to us from a remote antiq
and this is an insight into the music at the time
Govardhana's आर्यासप्तशती - an eminent predec
referred to by Jayadeva - so lived at the end of
11th century. तिक्कन or तिरुप्पाण - tradition says that he
a Cholian name पनाणार who preached to
Bhakti to Kṛṣṇa. After his death he was born
Jayadeva and wrote the Gīta Govinda. In the

Vocaul
Nāraṇaswāmi Śataka compared to Bhartṛhari's ... so ... must be assigned to the close of the 11th century. ... a lyric in praise of ... - 3 parts of 100 and odd stanzas. It's a significant name - the verses are a treat to the ear, music and charming they are ... by heart. The ideas here are so chosen and depicted that they are well adapted for being represented by gesture and ... अभिनय.

Kṛṣṇakarṇāmṛta. ... 1 mixed aphorisms in simple ... pleasing pictures of the Krishna's ... Bilhaṇa 12th century. This lyrical work ... recapitulating his pleasures with ... - 50 verses - ... when he was about to be executed for his ... marriage - his ... (her father) ... Śaundarya-laharī ... lyric.

Śrīdharadāsa. Sadukti-karṇāmṛta. ... of the 13th century. 1205 A.D. anthology of verses. ... from about 400 poets.

Meru-tuṅga - ... in religion ... historical taste - ... (Prabandha-cintāmaṇi) in 1306 A.D. - 18th ... of the ... history of ...

Rāṭṭa-kavi. His grandfather Rāghavadeva ... minister of Hammīra who reigned at Chittor in the 13th century. So his work can be assigned to about the middle of the 14th century. His Padārtha-kaumudī is an anthology of about 6000 verses, collected from 264 different authors ... 116 ... together. ... gems of Sanskrit Poetry under various headings.

Rājaśekhara. He was assigned to about the end of the 14th century ... a collection of half historical tales and biographies. The style resembles that of

[illegible] Tantra. His patron was [illegible] of the Shah [illegible]
a favourite of Mahammad Tughluk.

वैद्यनाथ/देशक/यादव का युद्धय 14th century. हेमचंद्र 25 - on the
widely [illegible] work, 4 drafts
the well known story of Rama & combing his dreads
of fiction [illegible] in Pampa Lake. the palm
may be formed [illegible] ; [illegible]
western cities. one article says : every strange
a clean drained [illegible] the whole forms a
pins effect at the feet of Rama. शुभाशितनीति
ethical piece in 12 padhatis.

मेघदूतसंदेशकी, गोस्तुटे पदपद्यानीस्तुति,
प्रशस्तिनामक [illegible] हस्तलेखनोपर. [illegible]
[illegible] a philosophical drama.
Jagaddhara 15th. century - a contemporary of King
[illegible] 1482 - 1484. He flourished about 15:
स्तुति कुसुमांजलि praising several deities. His myth
logical imagery [illegible] wonderful.
[illegible] Jinadatta Thakkura alludes to him
in [illegible] Kavya & metre 1460 AD ; it consists about
1365 AD. 3 small poems. - the [illegible]
कुवलयमालाकहा (Prakrit poem) प्रशस्ति [illegible]
text a collection of panegyrics in different Varn
-ular. the [illegible] work attrib
-ted. style very [illegible] and refined -
Bhatta Bhatta - His [illegible] was प्रशस्ति [illegible]

assigned to 1416 A.D. a collection of anecdotes, moral, rules for personal ceremonies & conduct, sketches of individual biography. proverbial expressions are abundant. ideas short & concise. whole work written in a flowery style. language shows much of literary acquaintance. very little history of it.

Dhanadatta. like Bhartrhari composed 2 Śatakas in short to ornaments. ideas
14 16 A.D. the language more advanced & more artfully clothed.

Śāyaṇa - elder brother of Mādhava & prime minister of Bukka. Sudra in caste
:. 15th century.
of Virūpākṣa brother of Bukka. eulogistic biography. author of 84 श्लोकs. meant to
inculcate the duties of a king.

Rāmācandra - दशरूपकावलोकनं - in 1524 A.D. - love, is the theme in one part and
the other part refers to renunciation. language learned though not musical. He might be the same as the Grammarian the author of the रसकल्पवल्ली.

Śrīhari - a contemporary of Emperor - 1566-1605.
शृङ्गारवल्ली - a wide collection of verses of great beauty.

Didactic poetry. Pañca Tantra, Hitopadeśa are the only surviving specimens serving a useful handbook of moral philosophy - illustrates the practical science of all didactic existence - illustrates the poetry. - Mahābhārata is an inexhaustible mine of proverbial sayings and a store the earliest work on didactic poetry.

आहारे विरतिः समस्तविषयग्रामे निवृत्तिः परा।
नासाग्रे नयनं नदेतदपरं यत्रैकतानं मनः॥
मौनञ्चेदमिदं च शून्यमखिलं यद्विश्वमाभाति ते।
तद्भूयाः सखि योगिनी किमपि भोः किं वा वियोगिन्यसि॥

अत्र नवाहारविषयकरागाभाव इव न तु योगिनीवदनिष्ट-साधनताज्ञानात् योगप्रतिकूलाहारानिवृत्तिरिति तस्याः प्राणधारणार्थमाहारोऽस्त्येव। नव तु सोऽपि नेति विषय-सप्तम्याः, योगसाधने यदृच्छोपागते च विषये तस्याः प्रवृत्तिरिव सर्वथैव विषयनिवृत्तिरिति समस्तेति विशेषणस्य, ध्यानसमय इव तस्या नासाग्रनेत्रत्वम्, निश्चैकाग्र्यं च नव तु सर्वदैव तदुभयं नथैङ्गितादिना अपि अर्थबोधरहितं मौनं चेति नदेतद्यदिमिति क्रमात् सर्व-नाम्नः, तं वियोगिन्येव न तु योगिनी इति उत्तरपद-दार्ढ्यसूचकस्य वेति निपातस्य च।

Dislike for food, extreme nonattachment to regards all the sense objects, the eyes concentrated on to the tip of the nose, and what is more a completely absorbed mind, this silence, and the whole world appearing as though it were vacant, – all these are found in you: tell me, o dear friend, whether you are a yōgini, an ascetic, or a Viyōgini suffering from the pangs of separation?

ನುಷ್ಯ ಪ್ರೇಮವನ್ನ ಬೆಳಸಿಯಕ್ಕೆ ಕಾಲ ಬದ್ದರೇಶವ
ಷ್ಟ ೪। ಮನೆದಿನವ ಬಂದಿಯಕ್ಕೆ ಬಿಡುಬಿಡುವೆ ಮನುಷ
ರೆ ಮನುಷ್ಯ ೪॥

ಮಾಡಬಾರದು ಎಂಬುದು ಬಾರದು [illegible] ||
[illegible] ಬಾರದು, [illegible]
[illegible] ॥ ನನ್ನ [illegible] ಬಾರದು । [illegible]
[illegible] ಬಾರದು [illegible]
[illegible]
[illegible] ಬಾರದು [illegible]
[illegible]
[illegible] ಬಾರದು ।
[illegible]
[illegible]
[illegible]
[illegible] । ನನ್ನ [illegible]
[illegible]
[illegible]
[illegible] । [illegible] ಬಾರದು
[illegible]
[illegible] ಬಾರದು [illegible]
[illegible] ನನ್ನ [illegible] ಬಾರದು [illegible]
[illegible] । [illegible]
[illegible] ಬಾರದು ॥ [illegible]
[illegible] ॥ ನನ್ನ [illegible]
[illegible]
[illegible]
[illegible] ಬಾರದು [illegible] । [illegible]

ಬಾಡುವುದು ಅಲ್ಲಿ ಹಿಳಿಸಿದ ತಿರು ಸಾಮಯುರೆಯ
ಚಾರಿಸ್ಟ್ರೀ ಬಾದ ಧ ವಸ್ತ ರೆಯಿಂಬ ಚಾರಿಸ್ಟ್ರೀ ತಾನು
ನರೆಳಿಯ ಬ ರ ಚಾರಿಸ್ಟ್ರೀ | ~~ಅಲ್ಲಿ~~ ಹಾದಿಸಿಲ್ಲಿ ಮುಲಿಸುವ ನಾಲ
ಯಮ ಕಂಡು ಕಿಲ ಕೆಲ ಹಿಲ ನೆನ ಹಾ ರಿಚಾರಿಸ್ಟ್ರೀ |
ಚಾರಿಸಿ ಬಿಡಿ ದಿ ಅರೆಯ ಮುಖಿ ಸಾಹಿಸಿಬಿ ಸ್ಟ್ರೀ ಚಾರಿಸ್ಟ್ರೀ
— ಹ್ರೀ ಸ್ಟ್ರೀ || ಸಾಧುಸಿಸ್ಟ್ರೀ ನರ. ಮಾನ ಬಿಕ ಚಾರಿಸ್ಟ್ರೀ —

Intensity at the N.P on N = $\frac{m}{NP^2} = \frac{20}{13.3^2} = .1$

" " " " P on S = $\frac{m}{SP^2} = \frac{20}{18.3^2} = .05$

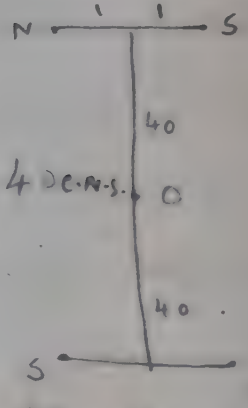
Resultant = .6.

(8) The length of the magnet = 2 c.M.S

$2l = 21$ c.M.S.

Distance of the N.T from the magnet = 40 c.M.S.

Here l is very small when compared to D.



So we can use the formula $\frac{2M}{d^3}$ for intensity at O

1st magnet $M_1 = 2 \times m \times l = 2 \times 15 \times 1$.

2nd magnet $M_2 = 2 \times m \times l = 2 \times 10 \times 1$.

Resultant = $\frac{2M_1}{d^3} - \frac{M_2}{d^3} = \frac{2 \times 15}{d^3} - \frac{2 \times 10}{d^3}$

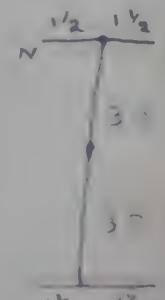
$= \frac{2}{40^3}(15-10) = \frac{2 \times 5}{40 \times 40 \times 40} = \frac{10}{4 \times 40 \times 40} = \frac{1}{640} = .00156$

(9) Length of each magnet = 3 c.M.S

$\therefore l = \frac{3}{2}$.

Here also l is very small when compared to d.

We can use the formula $\frac{m}{d^3}$ fo



Let M_1 be the moment of the [illegible] M_2 [illegible]

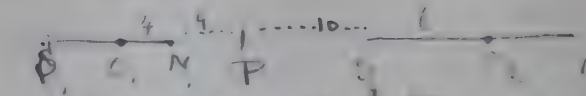
Resultant intensity $= \frac{M_1}{d^3} - \frac{M_2}{d^3} = \frac{2 \times m \times l}{d^3} - \frac{2 \times m \times l}{d^3}$

$= \frac{2 \times 20}{30^3} - \frac{2 \times 15}{30^3} = \frac{2}{30^3}(20 - 15) = \frac{2 \times 5}{30 \times 30 \times 30} = \frac{1}{1800}$

$= .00056$ gauss.

(10) The compass needle will show no deflection at a point where the intensity is zero.

Let the point be P.



Distance of the pt P from C, the centre of the magnet $= 4 + 4 = 8$ c.m.

Distance of the pt P from the ends of the longer magnet $= 10 - 4 = 6$ c.m.

Intensity at the pt P $= 0$.

Intensity at the point P on the smaller magnet.

$= \frac{2 \times m \times 2l \times d}{(d^2 - l^2)^2} = \frac{m \times 8 \times 2 \times 8}{(8^2 - 4^2)^2} = \frac{128m}{(64-16)^2} = \frac{128}{48^2}$

$= \frac{128\,m}{2304} = \frac{1}{18}$ m. [illegible]

Intensity at the point on the bisector of the magnet.

$$= \frac{2 \cdot 2m \cdot rd}{(r^2 - l^2)^2} = \frac{2 \times m_1 \times 12 \times 11}{(12^2 - 4^2)^2} = \frac{24 \times 16 m_1}{(256 - 36)^2} =$$

$$\frac{16 \times 24\ m_1}{220^2} = \frac{4 \times 4 \times 24 \times m_1}{220 \times 220} = \frac{24}{55^2}\ m_1$$

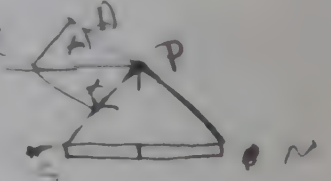
$$\frac{24}{3025}\ m_1 \text{ where } m_1 \text{ is the}$$

strength of the magnetic pole.

The ratio of the strengths $= \frac{1}{18} : \frac{24}{3025}$

$$= \frac{18}{18} : \frac{4 \times 2}{3025} = 1 : .143 \text{ Ans.}$$

(11) Intensity at a point horizontal vertical to the magnet and the point is in the perpendicular bisector of the magnet. $H = .377$.



The direction due to N-p in PA.

The direction due to Sp in PS.

The direction of the resultant is the diagonal through P.

(2) The moment of the magnet = M = 500.

m = pole strength = 50.

d = 15 C.M.S.

Resultant horizontal field strength at the point 15 C.M.S from the mid-pt of SN.

$$\frac{2Md}{(d^2-l^2)^2} = \frac{2\times 500\times 15}{(15^2-5^2)^2} = \frac{2\times 500\times 15}{(225-25)^2} = \frac{2\times 500\times 15}{200\times 200}$$

$2ml = M = 500$. $\quad l = \frac{500}{2\times 10} = 5$.

$m = 50$.

$\frac{2\times 500\times 15}{200\times 200} = \frac{3}{8}$ Gauss. $= .375$ gauss.

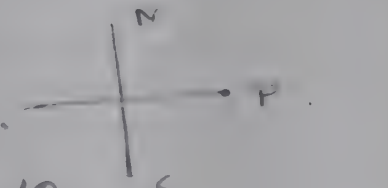
$\frac{2\times 500\times 15}{40}$

Horizontal Component of the earth's magnetic field $= .38$ gauss

Resultant horizontal field strength $= .755$ Gauss.

25.7.47. (14) The pole strength = 25.

Moment of the magnet = 250.



∴ The length of the magnet = 10.

Using the formula $\frac{M}{10^3} = H$.

$\frac{250}{10^3} = H$. $\quad H = \frac{250}{1000} = .25$ (Gauss)

(16) Moment of the magnet = 1000.

This is a short magnet.

∴ Formula $\frac{2M}{d^3} = H$.

$\frac{2 \times 1000}{d^3} = .32$.

$.38 d^3 = 2000$.

$d^3 = \frac{2000 \times 10}{38} = \frac{2000}{3.8}$.

$d = \sqrt[3]{\frac{2000}{38}} = \sqrt[3]{5263 \cdot 2} = 17.4$ (m.)

$\frac{1}{3} \log 5263 = \frac{1}{3} \times 3.7212 = 1.2404$.

Antilog 1.2404 = 17.4 =.

∴ $d = 17.4$ C.M.S form.

(22) Here it is given that

$2l = 10$, $d = 8$ $H = .38$.

$\frac{M}{(d^2+l^2)^{3/2}} = H$.

$\frac{M}{(64+25)^{3/2}} = .38$.

$= .38 \times 839.7$.

$= 319.1$.

$2l = 10$.

$2m = 319.1$

$m = \frac{319.2}{10} = 31.91$ Ans.

$\log 89 = 1.9494$

$\log 0.9747$

$1.9494 \times \frac{3}{2} = 2.9241$

Antilog 2.9241

$= 839.7$.

(23) It is placed with the north pole pointing north.

$\therefore \frac{M}{(d^2+l^2)^{3/2}} = H.$

$H = .36$. Distance between the pole and the [illegible] $= 20$ cm. $l = 1$ cm.

$M = H \cdot (d^2+l^2)^{3/2}$

$.36 = .36 (400 + 100)^{3/2} = .36 \times 500^{3/2}$

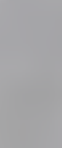
$= .36 \times 11180 = 4024.80$.

$2 \text{ m} \; l = [illegible]$

$\therefore$ The pole strength $= \frac{\text{[illegible]}}{2.0} = 201.3$

(24) The north pole is pointing north.

$\therefore \frac{M}{[illegible]} = H.$



$2l = 20$. $d = 15$. $H = .37$.

$M = H \cdot (d^2+l^2)^{3/2}$

$= .37 (225+100)^{3/2} = .37 \times 325^{3/2}$

$= .37 \times 5859 = 2167.83$. C.G.S. unit.

The [illegible] the [illegible] 2108 [illegible]

1-8-4-1

(27) The moment of the magnet = 180 c.g.s units.

In End on arrangement it produces a deflection of 45°.

$$\frac{M}{H} = \frac{d^3}{2} \tan\theta : \quad \frac{180}{H} = \frac{10^3}{2} \tan 45^\circ = \frac{1000}{2} \times 1.$$

$$\therefore H = \frac{180}{500} = .36.$$

In the broadside on deflection $\frac{M}{H} = d^3 \tan\theta$

$$\frac{180}{.36} = d^3 \cdot \tan 45^\circ \quad (\text{same deflection})$$

$$\therefore d^3 = 1 \times \frac{180}{.36} = \frac{18000}{36} = 500.$$

The distance in which the magnet would produce the same deflection = $\sqrt[3]{500}$

$$= 7.94 \text{ c.M.S.}$$

(28) It is placed in the East to West direction.

$$\frac{M}{H} = \frac{d^3}{2} \tan\theta. \qquad H = .38 \text{ gauss}$$

$$\frac{M}{.38} = \frac{20^3}{2} \tan 45^\circ = \frac{8000}{5} \times 1.$$

$$M = 4000 \times .38 = 1520 \text{ c.g.s units}$$

The moment of the magnet = 1520 c.g.s units

The length of the magnet = 8 c.M.S

pole strength $\frac{1520}{8} = 190$ c.g.s units

$$\frac{2Md}{(d^2-l^2)^2} = \frac{2 \times M \times 20}{(400-16)^2} = H \tan\theta = .38.$$

$$M = \frac{.38 \times 384 \times 384}{40} = 1401 \text{ C.G.S units}$$

$$m = \frac{1401}{8} = 175.1.$$

1) It is placed in the east to west direction.
The axis is ⊥ to the earth's magnetic field.
The axis produced passes thro the centre of the magnetometer.

When it is at 40 c.m.s, the deflection is 45°
when it is at 20 c.m.s the deflection is 30°.

$$\frac{m_1}{m_2} = \frac{\text{pole strength of 1st magnet}}{\text{pole strength of 2nd magnet}} \rightarrow \frac{\tan\theta_1}{\tan\theta_2}$$

$$= \frac{\tan 45^\circ}{\tan 30^\circ} = \frac{1}{1/\sqrt{3}} = \frac{\sqrt{3}}{1} \quad m_1 : m_2 = \sqrt{3} : 1.$$

$$\frac{M_1}{M_2} = \frac{d_1^3}{d_2^3}$$

$$\frac{M_1}{M_2} = \frac{d_1^3 \cdot \tan\theta_1}{d_2^3 \tan\theta_2} = \frac{40 \times 40 \times 40 \times \sqrt{3}}{20 \times 20 \times 20 \times 1}$$

$$= \frac{8 \times \sqrt{3}}{1} = \frac{8 \times 1.732}{1} = \frac{13.856}{1}$$

$\therefore M_1 : M_2 = 13.856$.

(31) It makes 50 oscillations in 250 seconds
∴ In one minute the number of oscillation executed by this $= \frac{60 \times 50}{250} = 12$ oscillations
$\therefore n_0 = 12$

distances are 10, 15, 20 c.m.s.
$d_1 = 10, d_2 = 15, d_3 = 20$.

Then the vibrating magnet makes 50 oscillations respectively in 100, 137, 164 seconds

$\therefore n_1 = \frac{60 \times 50}{100} = 30 \quad n_1^2 = 900$

$n_2 = \frac{60 \times 50}{137} = \frac{3000}{137} \quad n_2^2 = \frac{9000000}{137^2} = 479.5$

$n_3 = \frac{60 \times 50}{1,164} = \frac{750}{41} \quad n_3^2 = \left(\frac{750}{41}\right)^2 = 334.5$

$n_0 = 12 \quad n_0^2 = 144$

$n_1^2 - n_0^2 : n_2^2 - n_0^2 : n_3^2 - n_0^2$

$= 900 - 144 : 479.5 - 144 : 334.5 - 144$

$= 756 : 335.5 : 190.5 = f_1 : f_2 : f_3$

It is sufficient if we prove that

$d_1^2 (n_1^2 - n_0^2) = d_2^2 (n_2^2 - n_0^2) = d_3^2 (n_3^2 - n_0^2)$

~~$10^2 \cdot 756$~~

$d_1^2 (n_1^2 - n_0^2) = 10^2 \cdot 756 = 75600$

$d_2^2 (n_2^2 - n_0^2) = 15^2 \cdot 335.5$

$= 335.5 \times 225 = 75480$

$d_3^2 (n_3^2 - n_0^2) = 20^2 \cdot 190.5$

$= 400 \times 190.5 = 76200$

These are nearly equal.

The inverse inverse sq. Law is verified.

Earth's field.

(37) It oscillates 50 times in 60 seconds.

∴ In one minute the no. of oscillations = $\frac{60 \times 50}{60} = \frac{15}{2}$ oscillations.

under the action of a magnet.

It makes 50 oscillations in one minute.

$\therefore n_0 = \frac{75}{2}$, $n_1 = 50$.

$H = k n_0^2$; $f + H = k n_1^2$ $\quad H = .36$

$.36 = k \left(\frac{75}{2}\right)^2$ $\therefore k = \frac{.36 \times 4}{75 \times 75} = \frac{.16}{625} = \frac{16}{15625}$

$f + H = \frac{16}{625} \times 50 \times 50 = \frac{16}{25}$. $\quad f + H = .64$.

$H = .36$.

$\therefore f = .64 - H = .64 - .36 = .28$

$f = \frac{2M}{d^3}$. $d = 30$. $\quad .28 = \frac{2 \times M}{30^3}$.

$2M = .28 \times 30 \times 30 \times 30 = 27000 \times .28$

$M = 13500 \times .14 = 378000$ C.G.S Units.

(38) It executes 25 oscillation per minute, in earth field. $\therefore n_0 = 25$

When a bar magnet of length 10 cm is

Then placed at a distance of 25 c.m.s from it, it makes 30 oscillations per minute.

$n_0 = 25$. $H = h \cdot n_0^2$. $H = .36$.

$\therefore h = \frac{.36}{25 \times 25} = \frac{.36}{625} = \frac{36}{62500}$

$n_1 = 30$. $f + H = h n_1^2 = \frac{36}{62500} \times 30 \times 30$

$= \frac{324}{625}$.

$f = \frac{324}{625} - H = (.552 - .36) f = \frac{2M}{d^3} \left/ \frac{2Md}{(d^2 - l^2)^2} \right.$

$\frac{2M}{d^3} = \frac{2M}{(d^2 - l^2)^2} = .55$.

$\frac{2 \times M \times 25}{(625 - 100)^2} = \frac{50M}{525 \times 525} = .55$.

$M = \frac{.55 \times 525 \times 525}{50}$.

$f = .55 - .36 = .19$.

$f = \frac{2Md}{(d^2 - l^2)^2} = \frac{2 \times M \times 25}{(50^2 - 10^2)^2} = \frac{50M}{525 \times 525} = .19$

$\therefore M = \frac{.19}{50} \times 525 \times 525 = \frac{9975 \times 21}{2}$

$= \frac{20947.5}{2} = 10473.5$ C.Gms

Ans

(39) It makes 16 oscillations at the earth's field.

$\therefore n_0 = 16$. $H = k n_0^2 = .32 = k\,16^2$.

$\therefore k = \frac{.32}{15\times 16} \cdot 01 = \frac{.01}{8} = \frac{1}{800}$

When a bar magnet is placed, the number of oscillations = 20. $\therefore n_1 = 20$.

$f + H = k n_1^2 = \frac{1}{800} \times 20 \times 20 = .500$.

$H = .320$

$\therefore f$ = Strength of the magnetic field = .18 Gauss

(40) [illegible]

22-8-47

(40) It makes 100 oscillations in the earth's field.

$\therefore H = k n_0^2$. $.36 = k \cdot 100^2$. $k = \frac{.36}{10000}$

A magnet is placed near the needle in the same line.

Resultant field is H - F or F - H

according H > F or H < F.

$H - F = k n_1^2$ or $F - H = k n_1^2$.

$k n_1^2 = \frac{.36}{10000} \times 50 \times 50 = .09$.

$H - f = .09$ or $F - H = .09$.

H > F Then $F = .36 - .09 = .27$ } Gauss.

or F < H or $F = .09 + .36 = .45$ }

(41) It makes 20 oscillation per minute.

Time for one oscillation $= \frac{60}{20} = 3$ secs.

$T = 2\pi\sqrt{\frac{I}{MH}}$. $3 = 2\pi\sqrt{\frac{I}{MH}}$ where M is the moment of the magnet.

When it is remagnetised its pole strength is doubled ∴

∴ present Moment $= 2M$.

$$3 = 2\pi\sqrt{\frac{I}{MH}} \quad \text{—— (1)}$$

$$T_1 = 2\pi\sqrt{\frac{I}{2MH}} \quad \text{—— (2)}$$

Square Eq (1) and (2) and divide (2) by (1)

$$\frac{9}{T_1^2} = \frac{4\pi^2 I}{MH} \times \frac{2MH}{4\pi^2 I}.$$

$$\frac{9}{T_1^2} = 2. \quad 2T_1^2 = 9. \quad T_1^2 = 4.5.$$

$$T_1 = \sqrt{4.5} \quad \sqrt{4.5} \text{ secs}.$$

∴ The no of oscillation it will make

$$= \frac{60}{\sqrt{4.5}} = \frac{60}{2.1} = 28.28 \text{ oscillation}.$$

(42) 1st place.

No ~~A~~ oscillation

A The period for one oscillation = 3 secs

They are identical in all respects except moment

$\therefore I_1 = I_2$.

B. The period of oscillation = 4 sec.

Let M_1 be the moment of the A and M_2 be of B.

A $T = 2\pi\sqrt{\frac{I}{M_1 H}} = 3$. —— ①

B $T = 2\pi\sqrt{\frac{I}{M_2 H}} = 4$ —— ②

Square equation ① and ② and divide eq ② by ①.

$$\frac{B}{A} = \frac{4\pi^2 I}{M_2 H} \times \frac{M_1 H}{4\pi^2 I} = \frac{M_1}{M_2} = \frac{16}{9}.$$

$\therefore M_1 : M_2 = 16 : 9$

The period of oscillation of A in 2nd place

$2\pi\sqrt{\frac{I}{M_1 H_1}} = 5$. —— ① $= 5$.

$2\pi\sqrt{\frac{I}{M_2 H_1}} = x$ —— ②.

Square the 2 equations and divide eq ② by ①.

$$\frac{4\pi^2 I}{M_2 H_1} \times \frac{M_1 H_1}{4\pi^2 I} = \frac{M_1}{M_2} = \frac{x^2}{25}.$$

But $\frac{M_1}{M_2} = \frac{16}{9}$.

$\frac{x^2}{25} = \frac{16}{9}$. $x^2 = \frac{16 \times 25}{9}$

$\therefore x = \sqrt{\frac{16 \times 21}{9}} = \frac{4 \times 5}{3} = \frac{20}{3}$

$\therefore$ The period of B in the 2nd place $= 6\frac{2}{3}$

(44) A. $T = 2\pi\sqrt{\frac{I}{M_1 H}}$ $\left.\right\}$ $\frac{4\pi^2 I}{M_1 H} = \frac{60^2}{15} = 4^2$ — ①

$T = 2\pi\sqrt{\frac{I}{M_2 H}}$ $\left.\right\}$ $\frac{4\pi^2 I}{M_2 H} = \frac{60^2}{10} = 6^2$ — ②

The equation are squared.

Divide eq ② by ①.

$\frac{4\pi^2 I}{M_2 H} \div \frac{M_1 H}{4\pi^2 I} = \frac{M_1}{M_2} = \frac{36}{16} = \frac{9}{4}$.

$\therefore M_1 : M_2 = 9 : 4$.

Their moments of inertia are equal.

2nd place. Oscillates.

Let the horizontal intensity at that place $= H_1$

$T = 2\pi\sqrt{\frac{I}{M_1 H_1}} = 6$. $\therefore \frac{4\pi^2 I}{M_1 H_1} = 6^2 = 36$ — ①

3rd place: Oscillation.

Let the horizontal intensity at that place $= H_2$

$T = 2\pi\sqrt{\frac{I}{M_2 H_2}} = 3$. $\frac{4\pi^2 I}{M_2 H_2} = 3^2 = 9$ — ②

Divide eq ① by eq ②.

$\frac{4\pi^2 I}{M_2 H_2} \times \frac{M_1 H_1}{4\pi^2 I} = \frac{M_1 H_1}{M_2 H_2} = \frac{9}{36}$.

$\frac{M_1}{M_2} \times \frac{H_1}{H_2} = \frac{9}{36}$. $H_1 : H_2 = 1 : 9$

$\frac{9}{4} \times \frac{H_1}{H_2} = \frac{1}{36}$. $\frac{H_1}{H_2} = \frac{9}{36} \times \frac{1}{1} = \frac{1}{4}$.

Electricity

① F = Intensity of the centre. $\therefore \sin\theta = \frac{r}{r}$

Here $\theta = 90^\circ$ $\therefore \sin\theta = 1$.

The number of turns 50. Radius = 5 cm.

current = .1 ampere. $= \frac{1}{10}$ amps

$\frac{1}{10} = \frac{1}{10}$ amps.

$$F = \frac{\cdot 01 \times 2 \times \pi \times 5 \times 50}{25} = 2\pi \times .01$$

$$= \cdot 2\pi = \frac{2}{10} \times \frac{22}{7} = \frac{44}{70}$$

$$= .629 \text{ or } .63 \text{ Gauss.}$$

② Let the radius of the coil be r.

$F = i \cdot dS \cdot \sin\theta = i \cdot 2\pi r n$. (Absolute units)

$$= 10I \frac{2\pi r n}{r^2} = 10I \cdot \frac{2\pi n}{r}$$

$$F = \frac{10 \times 1.8 \times 2 \times \pi \times 2}{r} = .4.$$

$$r = \frac{10 \times 1.8 \times 2\pi \times 2}{.4} = \frac{72\pi}{.4} =$$

$$= \frac{i}{10} \cdot \frac{2\pi r n}{r^2} = \frac{1.8}{10} \times \frac{2 \times \pi \times 2}{r} = .4.$$

$$r = \frac{1.8 \times 4\pi}{10 \times .4} = \frac{7.2\pi}{4} = \frac{1.8}{4} \times \frac{22}{7} = \frac{39.6}{7}$$

$$= 5.66 \text{ M.S}$$

③ The number of turns = 50

The radius = 6 c.m.

Reduction factor = $\frac{10rH}{2\pi n}$ = k.

The current in amperes = Reduction factor × tan of the deflection.

We know that C = k tan θ

where k is the reduction factor.

Find for $\frac{10rH}{2\pi n}$. 3

Reduction factor = $\frac{10 \times 6 \times \cdot 2 \times 7}{2 \times 22 \times 5}$

$= \frac{6 \cdot 3}{110} = \cdot 0573$

④ $C = \frac{10rH}{2\pi n} \tan\theta$. (In amperes.)

Deflection = 23°. Diameter = 15 c.m. Radius = 7.5 c.m.

The number of turns = 2. H = .38

$C = \frac{10 \times 7.5 \times .38}{2 \times \pi \times 2} \tan 23°$

$\frac{75 \times 38 \times .4245 \times 7}{4 \times 22} \div \frac{2.9715 \times 25 \times 3 \times 19}{44}$

$= \frac{875}{11} \cdot 96$

.96 amperes.

⑤ Radius = 10 c.m.s . No of turns = 5 .

$f = \frac{2\pi n i}{r}$. (i Absolute.) = H tan θ .

$i = \frac{r H \tan\theta}{2\pi n} = \frac{\cancel{2} \times .35 \times .2887 \times 7}{\cancel{2} \times \cancel{2} \times 5}$ (11)

$= \frac{\cancel{2} \times \cancel{98} \times 2 \times 7}{\cancel{2} \times 7} = \frac{14 \times 63 \times 2}{7} = \frac{2.82926}{44}$

$= \frac{2.15 \times .2887}{11} = 2.15 \times .02625 = .056437$

Or = .05644 absolute

⑥ $I = \frac{10 r H}{2\pi n} \tan\theta$. (amperes .

Deflection produced = 30° . ∴ tan 30° = .5774.

Diameter of the coil = 20 c.m.s . Radius = 10 c.m.s = r

The number of turns = n = 10 .

Horizontal intensity = .38 = H.

$I = \frac{10 \times r \times H \tan\theta}{2 \times \pi \times n} = \frac{10 \times 10 \times .38 \times .5774 \times 7}{\cancel{2} \times \frac{22}{11} \times 10}$

$= \frac{1.9 \times .2887 \times 7}{11} = \frac{13.3 \times .2887}{11}$

$= 13.3 \times .02625 = .3491$ amperes.

R.J

ಮೂರಾರದ ಪೂರ್ವಾನ್ವೇಷಕರು, ಮೂರಾರನ್ನೇ ಬಾಳಿಸಿದವರು
ನಾದ.

ಪ್ರಾಚೀನ ನಡುಗನ್ನಡ ಭಾಷ್ಯ.

ಮೂರಾರ ಮದ: ಮೂರ್ಖ ಮಿ ದಂ ಮೂಢಾರ್ಥ ಕೆ ಮೂರಾರ ಎಂದರ್ಥ ಮೂರ್ಖನಿಗೆ
ಅವರೊಳಗೆ ಕೆಲವರು:- ಕೆಲವರು ಮೂರ್ಖರು ಮೂರ್ಖ, ಆ ಮೂರ್ಖರಿಂದ ಮೂರಾರನ್ನು ಬೇರೆಯಾಗಿ
ನಮ್ಮ ಲುವನಿಮಿತ್ತ ನಲ್ಲ ಶಾಂತಿ ವೀರದಲ್ಲಿ ಬಂದಿರುವ ಕಾರಣದಿಂದ ಈ
ಪರಿಯು ಪರಿಶೇಲಿಸಿದರೆ ಅಮ್ಮ ಪ್ರಾಚೀನ ಕಾಲದ ಕಂಚೀನನ್ನ
ಮೂರ್ಖ ಭರು ನಡುಗನ್ನಡ ಶಾಸ್ತ್ರದ ಪ್ರಮೇಯ ನಲ್ಲಿ ಅಮ್ಮ ಪ್ರಾಮುಖ್ಯವನ್ನು
ಪರಿಶೀಲ್ಯ ನಿಷ್ಕರ್ಷಂ ಬೂದನ್ನೆ ನಾವು ಮನನ ಮಾಡಿ ಬಹುದು. ವರಮುನಿಯನ್ನೇ
ಮೂರ್ಖ ಎಂದರೆ ಕನ್ನಡ ಮೂರ್ಖನೆಳಿ ನಂಬ್ಳಿಗಳ್ಳ ಮೂರ್ಖ ವರಮುನಿ
ಯೆಲ್ಲಿಂದು ಪ್ರೀಕ್ಷಿಸಿ, ಅಂಥ ಮೂರ್ಖ ದಿಂದ ಮೂರಾರನ್ನು ಕಳೆದರೆ
ಸಂಸ್ಕೃತಗಾಳಿಸಿದರೆ, ಮೂರ್ಖನೇ ಭಾಷಿ ಉಳ್ಳಾಯುವನೆಂದು ಅರ್ಥ ಸೊನದಾಗಿ ಬಂಗಿ
ಮುವರು. ನಾಲ್ಕಲುವನೇ ರನ್ನ ಗ್ರಾಧ ಪುರುಷನೆಂದ, ಆಂಜುನೆಂದ,
ನಂಧರ್ವನೆಂದ, ಅರ್ಥ ಭಾಸ್ತ್ರದಲ್ಲಿ ಈ ನಡುಗನ್ನಡ ಶಾಸ್ತ್ರಕ್ಕೆ ಪ್ರಶ್ನೆಗಳಾಗ
ಸ್ಥಾನವು ಪರಿಕಲ್ಪಿತವಾಗದಿದ್ದರೂ, ಆದರೆ ಗೌಡಾಂಧ್ರದಲ್ಲಿ ಪ್ರಮುಖವಾಗಿ
ಕೆಂಪಿನಂತಿರುವ ಪ್ರಶ್ನೆಗಳಿಕವನ್ನೇ ಆಧಾರವಾಗಿಟ್ಟುಕೊಂಡು ಬಂದಿರುವ
ನಡುಗನ್ನಡ ಶಾಸ್ತ್ರವನ್ನು ನಮ್ಮೆದುರಿಗೆ ಕೆಲವು ಪ್ರಶ್ನೆಗಳನ್ನು ಎಬ್ಬಿಸಿದಾದರೂ ಅದರಿಂದ
ದೇವನಹಳ್ಳಿ ನಡದವಿಷಯವನ್ನು. ಯಜ್ಞ ಕಳಿದ ಪ್ರಾರಂಭವಾಗಿರುವುದು
ಕನ್ನಡವನ್ನು ಬಳಸುವಲ್ಲಿ ನಡುಗನ್ನಡ ಶಾಸ್ತ್ರವು ಎಂಬುದು ಅಲ್ಲಿಯ
ಭಾಷಾಚಿಂತನವು ಎಂಬುದನ್ನು ಕೆಲವು ಪಾಶ್ಚಾತ್ಯ ವಿದ್ವಾಂಸರು ಹೇಳಿರುವ
ಬಿಂದು ಪ್ರಸಿದ್ಧ ವಾಗಿರುವ, ಈ ನಡುಗನ್ನಡ (Middle Kannada) ಎಂದು ಪ್ರಸಿದ್ಧವಾಗಿರುವ
ಶಾಸ್ತ್ರಕ್ಕೆ ಆಧಾರಭೂತವಾದ ನಡುಗನ್ನಡ ಶಾಸ್ತ್ರವು ಇನ್ನೆಂದು ಪ್ರಯುಖವಾದ

ಭಿನ್ನದ ಬಗ್ಗೆ ತಿಳಿದಿದೆ ಯು ಅವ್ಯಕ್ತಾಂಶ. ಸ್ಥೂಲಗಾದಿಗಳ, ವಕ್ರೀಭವನ
ಗಳ ಸ್ಥಾವಕ ಮತ್ತು ನ, ಸ್ಥಾವರ ಚಲನಾದಿ ಗಳನ್ನು ಕಂಡುಹಿಡಿಯುವರೆ, ಇಲ್ಲಿರುವ
ಯಾವುದೇ ಆಕಾರವನ್ನು ತೆಗೆದಿಯ' ಗಳೆಂದು ಪೆಡ್ಡಗಾದರು ಭೂಮಿಯ ಗುರು
ಸೋಲಿಕಲು ಅಮಳಾಲಗಾಮವಜ್ಞೋಕಿವೇಗಧಾಪಗಳು ದಿಕ್ಕು, ಗಾಳಿ, ಬೈಪ
ಲುಜ್ಜ ಯುನೀ, ಲಂತೆ ಇತ್ಯಾದಿ ಸ್ಥಿಪಗಳನ್ನು ನ್ಯಾಪನಲ್ಲಿ ಕರೆಗಾಗಿ
ಜ್ಯೋತಿಷದಲ್ಲಿ ಉಪಯೋಗಿಸಲಾಗಿದೆ. ಗಣಿತಾತ್ಮಕ ಪದಗಳನ್ನು ವಕ್ಷೇತ್ರವಿಜ್ಞಾನದಲ್ಲಿ
ಸೈಕೆಲ್ಲಾ ತಿಥಿ, ನಕ್ಷ, ವಕ್ಷೇತ್ರ, ಕರಣ, ಯೋಗ ಎಂಬವುಗಳನ್ನು ಪಂಚಾಂಗಗಳನ್ನು ಕ್ಷ
ರೀಕರಿಸಿಕೊಳ್ಳಲಾಗಿದೆ. ಕೆಲವು ಸಮಯವನ್ನು ಸೂಚಿಸುವ ಮುಂದಿನ ಪದಗಳು
ಗಣಿತದಲ್ಲಿ ಅಳತೆಗಳಲ್ಲಿ ಬಳಕೆಯಾಗುವ ಪದಗಳು ಸಂಕಲಿತ ಪುಸ್ತಕಗಳನ್ನು
ಸಿದ್ಧಾಂತ ಎಂದು ನಾವು ಇಂದು ಕರೆಯುತ್ತೇವೆ. 165 ಕ್ರಿಸ್ತಪೂರ್ವದಲ್ಲಿ ಬಾಬಿ
ಲೋನಿಯಾದ ಸೆಲ್ಯುಕಸ್ ಸಾಮ್ರಾಜ್ಯದಲ್ಲಿ ಬರೆಯಲ್ಪಟ್ಟ ಸೂರ್ಯಸಿದ್ಧಾಂತ, ಚಂದ್ರ
ಗ್ರಹಣಗಳ ಲೆಕ್ಕಾಚಾರ ಮತ್ತು ಸೂರ್ಯ ಚಂದ್ರರ ಚಲನೆಯ ಬಗ್ಗೆ ಸಂಕಲಿತ ಪುಸ್ತಕ
ಗಳಾಗಿವೆ. ಆರ್ಯಭಟೀಯ ಪುಸ್ತಕದಲ್ಲಿ ಸೂರ್ಯಸಿದ್ಧಾಂತ, ಚಂದ್ರಗ್ರಹಣ, ಸೂರ್ಯಗ್ರಹಣ
ಗಳ ಲೆಕ್ಕಾಚಾರ ಮತ್ತು ಸೂರ್ಯ ಚಂದ್ರರ ಚಲನೆಯ ಬಗ್ಗೆ ಸಂಕಲಿತ ಪುಸ್ತಕಗಳಾಗಿವೆ.
ಸಾಧಾರಣ ಪ್ರಮಾಣದ ಸಂಖ್ಯೆಗಳಿಂದ ಕೂಡಿದ ಜ್ಯೋತಿಷ ಪಂಚಾಂಗಗಳು ಇದ್ದ
ರೂ ಪ್ರಮಾಣದ (ಗಾತ್ರ ಸಂಖ್ಯೆ) ಜ್ಯೋತಿಷ್ಯ ಸೋಲಿಗಣಿತಜ್ಞರು ಸೋಲಿಯಂಬುದನ್ನೆ ಕೆಲವೆಡೆಗಳಲ್ಲಿ
ಉತ್ತಲೆದೋಲಿದೆ. ಅವನಕಲಿಗಳಲ್ಲಿ ಜ್ಯೋತಿಷ ಗಣಿತಜ್ಞರನ್ನು ಪ್ರಮುಖವಾಗಿ ಸೂರ್ಯ
ಗಣಿತಜ್ಞ, ಚಂದ್ರಗ್ರಹಣ ಗಣಿತಜ್ಞ, ಸ್ಥಾನಿಕ ಗ್ರಹಗಣಿತಜ್ಞ, ರಜ್ಜು ಗಣಿತಜ್ಞ (ಛೇದಗಣಿತ), ಶಂಕು
ಗಣಿತಜ್ಞ (Rule of three), ಕಲಾ ಸವರ್ಣನ ಗಣಿತಜ್ಞ (fractions) ಎಂದು ವಿಂಗಡಿಸಲಾಗಿದೆ.
ಯಾವತ್ತಾವತ್ = unknown quantity = x), ವರ್ಗಸಮೀಕರಣ

quadratic equation, Arithmetical or Geometrical progression
ಆದಿಮಿಶ್ರಧನ, ಘನಸಮೀಕರಣ (cubic eqn), ವರ್ಗವರ್ಗಸಮೀಕರಣ (biquadratic eqn)
indeterminate equation ಅವಿಶ್ಲೇಷಿತ ಸಮೀಕರಣ ಇತ್ಯಾದಿ ಪಾರಿಭಾಷಿಕ
ವಿಷಯಗಳನ್ನೆಲ್ಲ ಸಂಗ್ರಹಿಸಿಕೊಂಡಿರುತ್ತೆ. ಇದಲ್ಲದೆ ಇನ್ನೂ ಅನೇಕ ಅವಶ್ಯಕವಾದ ವಿಷಯಗಳನ್ನು
ತನ್ನಿಷ್ಟ ಬಂದಂತೆ ಬೇಕಾದಷ್ಟು ಉದಾಹರಣೆಗಳನ್ನು ಕೊಟ್ಟು ಸಮಗ್ರವಾಗಿ ವಿವರಿಸಿದೆ. ಉದಾ:
ಸಮಾನಾಂತರ ಶ್ರೇಢಿ, ಗುಣೋತ್ತರ ಶ್ರೇಢಿ, ಭಿನ್ನರಾಶಿಗಳು fractions, ವ್ಯಸ್ತಾನುಪಾತ (inverse
rule of three), ಸಪ್ತಾಂಶ, ಮಿಶ್ರಧನ, ಚಕ್ರಬಡ್ಡಿ, ಭಿನ್ನರಾಶಿ ಭಿನ್ನರಾಶಿ (chain rule)
ಮತ್ತು examples ಇತ್ಯಾದಿ ಹೀಗೆ ವಿಷಯಗಳನ್ನು ನಿರೂಪಿಸಿದೆ. ಕೆಲವು ಕಡೆ ಸಮಸ್ಯೆಗಳಿಗೆ ಉತ್ತರ
ಮಾತ್ರ ಕೊಟ್ಟಿದ್ದಾರೆ. ಉತ್ತರ ಮತ್ತು ಪ್ರಶ್ನೆಗಳನ್ನು ಒಟ್ಟಿಗೆ ಕೊಟ್ಟಿದ್ದಾರೆ. ಕೆಲವು ಕಡೆ ಪ್ರಶ್ನೆಗಳನ್ನು
ಮಾತ್ರ ಕೊಟ್ಟಿದ್ದಾರೆ. ಕೆಲವು ಕಡೆ ಪ್ರಶ್ನೆಗಳನ್ನು ಮಾತ್ರ

ఒడిసెలగాడు

తేలిక్క చుదురించుక్కి కొంచుకొంచు, బిడ్డ వచ్చినాకా 495 రూపాయలు అవి
మాదిరే, ఒక్కొక్కటి నిశ్చితమైన విలువ కలిగి ఉండవచ్చు. అంటే 1, 2, 3, ... వీటి
99. ఇక్కడ ఇచ్చిన సంఖ్య గణిత - 16వ శతాబ్దపు గొప్ప గణిత శాస్త్రవేత్తగా
తులిచుకెదింద 6 దశాంశ స్థానాలకి ఖచ్చితమైన విలువ కనుగొన్నాడు
ఇది ఇరవై వ శతాబ్దంలో. ఈ సంఖ్యని నిర్ణీత ఖచ్చితత్వంతో
indeterminate equation
గుర్తించే $ax^2+1 = by^2$ అనే ఆ సమీకరణంలో కనుగొన్నాడు 1700
వేల సంవత్సరాల క్రితమే ఈ సంఖ్య విలువ ఎంత విలువని ఖచ్చితంగా
గుర్తించాడు. ఈ ఇరవై అంకెలని ఇవ్వడం కోసం ఎంత కష్టపడ్డాడో కదా! (క్రీ.శ. 477 A.D)

ఆర్యభట్ట ఒక్కడే కాదు అనేకమంది ఇతర భారతీయ గణిత శాస్త్రవేత్తలు
ఈ సంఖ్యని కనుగొనడానికి ప్రయత్నించారు. వారిలో కొందరి పేర్లు ఇక్కడ ఇస్తున్నాను.

ఆర్యభట్ట: 3.1416
బ్రహ్మగుప్త: $\sqrt{10}$
శ్రీధరాచార్య: $\sqrt{9.87}$
మహావీరాచార్య: $\frac{\sqrt{9+16+25}}{3}$

ఇలా ఎన్నో ఉదాహరణలు ఇవ్వొచ్చు. కానీ ఇవన్నీ ఆ సంఖ్యని
కనుగొనడానికి చేసిన ప్రయత్నాలు మాత్రమే. ఇవి ఆ సంఖ్యని
ఖచ్చితంగా కనుగొనలేకపోయాయి. ఆ సంఖ్యని ఖచ్చితంగా కనుగొన్నది
ఆర్యభట్ట అని ఇంతకుముందే చెప్పుకున్నాం కదా!

ఇప్పుడు ఆర్యభట్ట ఈ సంఖ్యని ఎలా కనుగొన్నాడో చూద్దాం:

ఆర్యభట్ట తన పుస్తకంలో ఇచ్చిన శ్లోకం ఇది:

సులభమైన పదాలతో, చక్కటి పద్యంలో ఇచ్చినా, ఆ శ్లోకం
కొంచెం క్లిష్టంగానే ఉంటుంది, అందుకే ఇంకొంచెం సులభంగా చెప్పుకుందాం.

Sir William Jones అనే ప్రసిద్ధ బ్రిటిష్ పండితుడు ఈ శ్లోకాన్ని
ఇంగ్లీషులోకి అనువదించాడు. ఆ పద్యాన్ని ఆధారంగా చేసుకుని
రంధరభట్ట, పుత్తా రకాంబ అనే ఇద్దరు భారతీయ పండితులు
ఒప్పారులేను. వీరు ఆర్యభట్ట చెప్పిన సంఖ్యని ఎలా కనుగొన్నారో

ಭಾಷೆಯಲ್ಲಿ ಶೂನ್ಯವನ್ನು Arabic numerals ಎಂದು ಹೆಸರಾಗಿದೆ. ಶೂನ್ಯಕ್ಕೆ ಸಂಸ್ಕೃತದಲ್ಲಿ Nirlam ಎಂದು ಪ್ರಸಿದ್ಧವಾಗಿ ಸ್ವರ್ಗ ಶೂನ್ಯವನ್ನು ಬಳಸುವುದೆಂದು ಅಭಿಪ್ರಾಯವಿದೆ. ಬಾಸಿರುವ ಸಂಖ್ಯಾಂತರವನ್ನು ಸೂಚಿಸಲು ಬೌದ್ಧಿಯವರು ಶೂನ್ಯವನ್ನು ಬಳಸಿದ್ದರು ಎಂಬ ಅಭಿಪ್ರಾಯವೂ ಇದೆ. Pythagoras ಕಾಲದಲ್ಲಿ ಸಂಖ್ಯೆಗಳನ್ನು ಅಕ್ಷರಗಳಲ್ಲಿ ಬರೆಯುತ್ತಿದ್ದರು. ಇದರಿಂದ ಸಂಖ್ಯೆಗಳನ್ನು ಬರೆಯಲು ಕಷ್ಟವಾಗುತ್ತಿತ್ತು. ಉದಾ: 112 ಎಂಬ ಸಂಖ್ಯೆಯನ್ನು ಕಂಠೂಡಿಯಲ್ಲಿ ಬರೆಯಲು ಶತಮಾನ ಬೇಕಾಗಿತ್ತು. ಇದರಿಂದ ಸಂಖ್ಯೆಗಳನ್ನು ಬರೆಯಲು ಸುಲಭವಾಗಲೆಂದು Place value notation ಅಂದರೆ ಏಕಸ್ಥಾನದಲ್ಲಿ ಶೂನ್ಯ, ದಶಸ್ಥಾನದಲ್ಲಿ ಶತಸ್ಥಾನದಲ್ಲಿ ಶೂನ್ಯ ಹೀಗೆ ಬರೆಯುವ ಪದ್ಧತಿಯನ್ನು ಇದರಿಂದ ಬೇರೆಡೆಯಲ್ಲಿಯೂ ಬಳಸುವುದು. ಭಾರತೀಯ ಶಬ್ದಗಳು ಬಹಳ ಸಂಖ್ಯಾತಾತ್ಪರ್ಯವನ್ನು ಸೂಚಿಸುತ್ತಿದ್ದವು. ಉದಾ: ಸಪ್ತ ಸಮುದ್ರ, ಸಪ್ತ ಪರ್ವತ, ಸಪ್ತ ಕನ್ಯೆಯರು, ಸಪ್ತ ಋಷಿಗಳು ಇದರಲ್ಲಿಯೂ ಸಂಖ್ಯೆಯನ್ನು ಅರ್ಥೈಸಿದ್ದಾರೆ. ಕಡಿತನಲ್ಲಿ ಬ್ರೌಂಟೀದಿಯೇ ಅಂತರ ಸಮಸ್ಯೆ ಕೊಂಡ ಎಂದು ಹಿಂದೀಕವಿಯು ಹೇಳಿ ಬಂದು ಯಶಸ್ವಿದ ಅಭಿಪ್ರಾಯದಿಂದ ಹಿಂದುವನ್ನು ವಿವಿಧ ಚಿಲ್ಲೆಯು ಅರ್ಥವಿಲ್ಲದೆ ಬೀರುತ್ತದೆಂದು ಹೇಳುವನು. ನಂಬಿಕೆಯಲ್ಲಿ ಶೆಲವು ಸಮ, ಶೆಲವು ಅನಮಸ್ಕಾರಿಂದು ಮೊದಲೇ ಪರಿಣಾಮಿಸಿದ್ದರು. ನಂಬಿಕೆಗಳು ಅವಧಿಯನ್ನು 18ನೇ 19ನೇ ಶತಮಾನದವರೆಗೂ ಸಾಗಿಸಿದರೆಯೂ ಇವರಿಂದಲೇ ನಲ್ಲಿ ಕೆಲ್ಕ್ಯುಲೇಟರ್ (computer ಗಣಕಯಂತ್ರ) ಗಣಿತಶಾಸ್ತ್ರವನ್ನು ವಿಜ್ಞಾನವಾಗಿಯೂ ಬೆಳೆಸಿದವರು ಯೂರೋಪಿಯನ್ನರು; ಮೊಟ್ಟಮೊದಲಿಗೆ ಯಾಂತ್ರಿಕ ಲೆಕ್ಕಾಚಾರಕ್ಕೆ ವಿಜ್ಞಾನವಾಗಿ ಬೆಳೆಸಿದವರು ಸ್ಕಾಟ್ಲೆಂಡ್ ದೇಶದ ಜಾನ್ ನೇಪಿಯರ್ ಎಂಬ ಗಣಿತಜ್ಞನು ಲಾಗರಿದಮ್ಸ್ ಕಂಡುಹಿಡಿದ ಮೇಲೆ ಗಣಿತಜ್ಞರು

ರು ಆನಾಲ್ಯ ಶಾಸ್ತ್ರಗಳಲ್ಲಿ ಗಮನಾರ್ಹ ಶಾಸ್ತ್ರ ಪೆಂದೆಂದರು ಗಮನಿಸಿರುವರು. ವಿಚಲ್ಲಿ ಮತ್ತೆ
ದಲ್ಲಿ ಆರ್ಯ ಭಟಮ ಉಜ್ಜಯಿನಿಯಲ್ಲಿ ಬ್ರಹ್ಮಗುಪ್ತ ಭಾಸ್ಕರರು ಮೈಸೂರಿನ
ಲ್ಲಿ ಮಹಾವೀರನು ಶಾಸ್ತ್ರವನ್ನು ಕುಲಂಕಷವಾಗಿ ಗಳಿಸಲು ಪದಲ್ಲಿ ಪುರೇವಾದಿಸ
ನಮ್ಮ ದೇಶದ ಕೇರ್ತಿಗೆ ಆದಿಯಂದ್ರಂಭ ಗಳಿದ್ದಾರೆ. ಇವರಧ್ಯಯ್ಯಾಂತರಗಳಲ್ಲಿ ಪ್ರೇಶಿಷ್ಯರು
ದರಿಪ್ರತಿಯೆಲುಂದುದ್ಯಯ್ಯಾಂತರವು ನಮ್ಮ ದೈನಂದಿನವ್ಯವಹಾರಕ್ಕೆ ಅತ್ಯಂತಅವ
ಯಕ್ತವಾಗಿ ನಮ್ಮ ಜೀವನವನ್ನೇ ಹಾಸು ಹೊಕ್ಕಿದೆ. ಇನ್ನಾದಿಕಾದಲ್ಲಿ ಯುಕ್ತರವಲ್ಲಿ
ಉತ್ತಮಗಣಿತ ಶಾಸ್ತ್ರಗಳನ್ನು ಅಮೂಲ್ಯವಾದ ಚಿನ್ನಲ್ಲಿ ಬ್ರಹ್ಮಗುಪ್ತನೇ ಮೊದಲಾದವನ್ನು
ನಾವು ಹೆಸರಿಸಬಹುದು.

2/1 ಉದಾಹರಣಾರ್ಥವಾಗಿ ಮಹಾವೀರನಗಣಿತಸಾರದಿಂದ ವರ್ಗಸಮಖಂಡವ್ಯವಹಾರ
ಗಣಿತಶ್ಲೋಕ-ನ್ಯಾಯಾರ್ಥವಯಂ ಗೃಹೀತ್ವಾಲ್ಪಿ ತ್ರಿಪುರಾಧಿನಂ ಪ್ರತಿ ಮಹಾವೀರನಾಮ ಜೈನಯತಿ
ಯಃ ಪ್ರಭುಃ ಅಹಿಂಸಾಯಾಂ ನಸ್ಯ ಕಿಯದ್ಧಿ ತಮಾನದೇವ. ಕ್ರಿ.ಶ 374.
ಇದಕ್ಕೆ ವಿವಿಧತರವಾಗಿ ಶಿಕ್ಷಣಕ್ರಮದಲ್ಲಿ Smkr, BA ಮುಂತಾದಲ್ಲಿ
ನಾವುಗಳು ಯುವಜನಾದಿಂದುಲಿಕ್ಕೆ ನಮ್ಮ ಜೀವನಶೈಲಿಯಲ್ಲಿ
ಬಳಿಯಾದರೂ ಉಪಯೋಗವಿದೆಯೆಂಬುದನ್ನು ಹೇಳಬಹುದು. ಶೋಧಿಸುವ
ವೀರನಯನಲ್ಲಿ ವನ್ನೆತ್ತಿ ನೋಡಿದರೆ, ಪಶಿಕ್ಷಣವಲ್ಲಿ, ಪ್ರವಿಶೋಧನೆಯಲ್ಲಿ, ವರಸೂಚಿಸಿದ್ಧಾಂತವಲ್ಲಿ ಉಪಯೋಗವಿದೆಯೆಂದು
ಹೇಳಬಹುದು.
ಇನ್ನು ಪ್ರತ್ಯಕ್ಷವಿನ - ಕುಂಭ್ಯಾಂ ಜಲಸ್ಯ ಲಭತೇ ಭವನಸ್ಯಾಂತಂ ಪಂಚಾನ್ನಯಃ ಮುಖ್ಯ
ತೈಲಸಿಚ್ಚುಪಿನಮೇ ರ್ಧಂತ್ರಿಸ್ಯಾಂಶೇನ ವಲಾಮಿಭಾಗೇನ.
ವಲಗುಂಡಿಕೆಯಾಗಿ 1/2 ವೈಶಾಖಸ್ಯ ಯಮಾಕೆ ಕೂಡಿರುವಿಯ 1/8 ವಲ
ಕ್ಕೆ ವಸುಕ್ಷಯ ಬಂದಿದೆ!
ವಲ್ಲೋಲ್ಲಾ ಯಮೋ ಚಿಂತಿತಃ, ಅಸ್ರಮ್ಭಃ ಶೋಭಿತಕಲ್ಲೋಲಂ ಚುಲುಮಃ
ಕಾರ್ಯಕ್ಕೆಲ್ಲವ್ಯಕ್ತಿಕ್ಕೆ ಯಥಾ ಕರ್ಮಾಲಸಿಕ್ಕಃ ಮಯಃ
ಕನಕಚಲಾಚ್ಛಮಯಂ ಪ್ರತಿಬಿಂಬಿಸಿದಂತೆ ಗಲ್ಲಿ ಚ
ಫಲಮನುಭಿಸಿ ಚಕ್ಷ್ಯತೆಲ್ಲಿಲನರಯೋಗಾತಿಯ್ಯ ಮದನಂ ಚೈವಲ.
ಭಾಯಕ್ಷಪ್ರತಿಕದಗಳಿಕೆಯಲ್ಲಿ ನಮ್ಮನ್ನಾಮತನ್ನ ನೇರಗಿನಲುದ್ದಕ್ಕೆಲ್ಲಿಯಿಂದ ಇಂತೆಲ್ಲಾ
ದುಃಖಕ್ಕೆಂದ ಹೊಮ್ಮುಲಿಯಲ್ಲಿ ಕಾಣುವಿಕ್ಕೆ ಕಾಣುವಿಕ್ಕೆ

ಇಂದಿನ ಕಾಲಘಟ್ಟದಲ್ಲಿ ಅನುಸರಿಸಲಾಗುವಂತೆ ಇವರು ಪಂಚಾಂಗವನ್ನು ಹೇಳುವುದಿಲ್ಲ
ಬದಲಿಗೆ ಪಂಚಾಂಗವನ್ನು ಅಂದು ಹುಟ್ಟಿರುವವರು. ಅಂದರೆ ಪ್ರತಿಯೊಂದು ಪಂಚಾಂಗದಲ್ಲಿ
ನಾಂಕೇತವಾದ ದಿನಕ್ಕೆ ಅಂದಿನ ವಿಷಯವನ್ನು ತಿಳಿಸಿ, ಮತ್ತೆ ಸ್ಥಾನ ಪಡಿಯಲ್ಲಿ ಆರಂಭಿಸಿ ಪಂ
ಚಾಂಗವನ್ನು ನಿರ್ದೇಶಿಸುವರು. ಉದಾ: ಭೌಂಮಿ ಎಂದರೆ 3, ಚಂದ್ರನೆಂದರೆ 1, ತಂಗಳು
2, ಆಕಾಶವೆಂದರೆ 0. ಸೂರ್ಯ, ಚಂದ್ರ, ತಂಗಳು, ಆಕಾಶ, ಮತ್ತು ಭೌಂಮಿಯೆಂದರೆ 30 ಎಂದರ್ಥ. ಈ ತರಹ ಪಂಚಾಂಗವನ್ನು ವಿದ್ವಾಂಸರು ಬಿಡಿಸಿ ಹೇಳುವುದಿಲ್ಲ. ಕೇವಲ ಪಂಚಾಂಗವನ್ನು ಕೊಂಡುಕೊಳ್ಳುವಾಗ ಮಾತ್ರ ಪುರೋಹಿತರನ್ನು ಇಷ್ಟೆ ಕೆಲವು ಚರ್ಚೆಗಳಾಗುತ್ತವೆಂದು ಪರಿಗಣಿಸಿ ಇವರು ಪಂಚಾಂಗ
ಓದುವಾಗ ಸಪ್ತಸ್ವರಗಳು ವಿವಿಧ ವೈಶಿಷ್ಟ್ಯಗಳನ್ನೇ, ಸೂಕ್ಷ್ಮ
ಶಬ್ದಾಲಂಕಾರವನ್ನು ಇಷ್ಟೆಷ್ಟು ಬೇಕಾಗಿದೆಯೆಂದು ಲೆಕ್ಕಾಚಾರ ಹಾಕುವ ಸಾಮರ್ಥ್ಯವನ್ನು ಇಂದಿನ ಇಲ್ಲಿ ಹೇಳುವಳು. ವೇದಿ: ಸಮುಚ್ಚಯಸ್ಯ ನಾಸ್ತಿಭುಗಡಸ್ತ
ಸಮುದ್ಯೋಗ: ಪ್ರಭವತಿ ತಾವದಿಷ್ಟಾಗಿ: ತತೆ ಇಷ್ಟಾಗಿ: ತಥಯನಾಮತ್ತ

The Aryan Path for August publishes a learned article on the Arya The Nobleman wherein the author mentions how the Buddha called himself an Arya or a Jina and Contrasted the Arya with a 'dasyu' who is black and who does not lay any claim to spirituality. The emphasis there has been mainly on the Buddhistic connotation of the word While we wish to show that this Contrast between the 'white' and the 'black' professions can be noted almost in every page of Sanskrit Literature.

The white or the noble profession has been allegorically deprived by our Puranic poets as the Hamsapaksha as Contrasted with the black or the kakapaksha. Our Puranic poets loved to speak in lovely parables and created these two birds. The virtuous man was always Compared to a swan and the Capacity for separating milk from water which the bird is supposed to possess was availed of as a model lesson for the good man who was

advised similarly to appreciate only the Virtu
and eschew the Vices of the men coming into
contact with him. The Sanskrit moralist Bhart
compared such men also to a coconut tree which
remembers gratefully the water poured at its f
years ago and preserves water on its head, anxio
waiting to return its debt. Similarly the moralist Kali
asked the good man to imitate a tree which unr
fishly receives all the heat of the sun on its head
and provides not only shadow but fruits to the per
that sits in its shade. On the contrary, the wicke
man is very often compared with a vile crow
which always waits stealthily to snatch away a
food however dirty it might be. By the way, it mu
be also noted that the 'hamsa' loves only to drink
the sweetest and the most pure water of the
Ganges alone: when the water happens to get
brackish or shows a tendency to be muddy at
the beginning of the monsoon, the swan passes
through the Hamsadwara or an aperture throu

the Krauncha mountain to the Manasa sarovara on the other side where there is no contamination of the water by the monsoon.

The Dronaparva of the Mahabharata epic has a lovely story to illustrate this contrast. The crow brags about its so-called powers and even boasts that it can easily fly across the ocean while the silent swan listens without any comment. It so happens that both the crow and the swan start on their journey across the sea together and the vile crow half way comes to grief and falls; but the noble swan slowly manages to help the crow across and lands it safe on the other side of the ocean. Salya, the maternal uncle of the Pandava twins, remembers his promise to his nephews and when Duryodhana proposes to Salya to be a charioteer to Karna in his ensuing fight with Arjuna, narrates this story, Comparing Karna to a vile crow and Arjuna whose fame is as white as his name to the swan in the story. Similarly the Bhagavata Purana draws an

interesting Contrast between a Vayasa tirtha and a Hamsa tirtha and declares that swans do not at all like to dwell in such Vayasa tirthas as they always like to dwell only in places which are ~~full~~ of resplendent with light; 'Nishikshayas'. In the Context in question, it is emphatically asserted that the place where the Lord's glory is not enthusiastically sung is a vile place where only crows will breed.

This Contrast between the crow and the swan can be traced in individual poets also. Kalidasa refers to this proverbial capacity of the swan drawing out only the milk and refusing the water in the Context where he makes Dusyanta declare that his arrow will recognise the enemy to be killed and save the friend in distress. Bana the greatest prose writer has a beautiful passage in his Harshacharita Ucchvasa or chapter where the King Pushpabhuti, a remote ancestor of the poet's patron Srikarsha Harsha attacks a Naga or the snake, who pretends to be the spiritual overlord of the field in question and

challenges him saying: 'are kākodara kāka, mayi sthite rājalaṅghe na jihresi balim yācitum.' Here the Nala chieftain is supposed to possess a stomach as vile as that of a serpent. Over and above the contrast drawn between a crow and a royal swan (as the King compares himself with), there is another notable point here and that is the vile person is supposed to have a poisonous stomach and will always vomit poison only. The vile creeping serpent is another example for a vicious person and the moralist in Sanskrit has another instructive verse comparing such person to a mosquito or a maśaka. This mosquito hovers round our feet (with a sinister purpose), bites our back, moves about our ears humming sweetly; after this it slowly feasts on our blood most unsuspiciously just as a vile person or a tale-bearer does.

The comparison of a vicious person to a crow is not peculiar to Sanskrit alone. Even in English, the word crow has colloquially acquired such a very sinister significance. Even the word scarecrow actually refers

to an ugly effigy that is prominently hung up in a fie
say to scare away wild birds that might destroy th
harvest.

The word Hamsa besides meaning swan has al
acquired another noble connotation. It refers to a
particular order of holy Yatis or Swamijees who
happen to be the religious Pontiffs presiding over
the Mathes. Some of these holy Swamijees are also
Paramahamsas and not merely Hamsas. These
are supposed to illuminate our spiritual
path to moksha. They are the torchbearers whose
duty is to hold aloft the lamp of spiritual
perfection. One such was the ancient Sage
Vishwamitra whose very name means friend
of humanity. It was he that taught us our
Gayatri and qualified himself to be a univ
friend. The word Hamsa also refers to the highest
Naturally therefore the word refers to the way and th
goal of the Hindu pilgrim in his path towards perfection. No wonde
therefore that the word refers to the "noble path of Spiritual

Even the person passing off inferior goods as superior is regarded as a thief and punishment is prescribed as for example by Dandavivekā of Vardhamāna. He says on p 100 (Baroda Edition) 'cheaper medicines, oils, salts, sandalwood, grains and jaggery if passed off as of superior quality warrant punishment.' The fortunish substituting inferior gold is referred to as savakantakapāpiṣṭha on the next page. Similarly the person passing kastūri scent into black mud and labelling the same as kastūri and marketing it, cat's skin properly coloured and passed off as tiger's skin, ordinary crystal coloured red and passed off as Padmarāga or ruby, coloured cotton thread marketed as silk thread, iron vessel coated with white marketed as silver, bilva wooden piece passed off as sandalwood by soaking it in sandalwood paste etc is to be punished; also the washerman wearing the clothes entrusted to him for wash, the person who on false pretext swindles money, who receives money for teaching any art but does not keep up the contract, merchants using false weights, doctors drafting on the treatment only

to exact more fees, persons posing as 'foretellers' only to deceive believing clients, regular thieves who bore a hole in the wall & commit burglary, pickpockets in broad daylight, persons waylaying travellers & demanding their goods with threats, kidnappers of men, women & children, persons decently dressed and parading bogus degrees or diplomas, persons lifting cattle are to be punished. Severe punishment was to be meted out to the 'pickpocket' who is called उत्कृत्तक or 'lifter' उत्कृत्तिसन्धिक - 'knot-breaker' by Manu and Yajnavalkya who decreed that when caught red-handed for the first time their fingers were to be cut, second time hands or legs to be cut, further repetition being summarily punished with death.

Laghu Bhaskariya of Bhaskara - Commentary by Shankaranarayana. published by the Curator, University Manuscripts Library, Trivandrum. Price Re 1-8 o pages.

Reprinted from the Journal of the Trav. University oriental Mss. Library (T.S.S. No. 62) the ancient classic written by Bhaskara on Astronomy known as Laghu Bhaskariya has now been issued as an independent Volume and should convincingly demonstrate the truth that even without scientific appliances, instrument, or equipment that are today available to modern astronomers, ancient Indian astronomers had been able to make solid and substantial contributions to the world's stock of knowledge of the mystries of terrestrial phenomena, movements of planets, eclipses & so forth.

The Volume here noticed contains the text in Sanskrit & a Commentary entitled Kiranavali. In the course of a learned & scholarly introd- Mr P.K. narayana Pillai has pointed out that Ancient Indian astronomy had been enriched & expounded by two Bhaskaras. Bhaskara I flourished in the 6th Cen. while the second Bhaskara, the celebrated author of the Siddhanta Siromani lived in the 12th Cen. Bhaskara I must have written 2 works

one a larger & more exhaustive version known as Brihad Shas
& the other an epitomised version and entitled it as Laghu Shas
The Commentary should have been written about 869 A.D.
Mr Pillai has explained the historical significance of the work
& come to the conclusion that king Ravi Varma Kulashekha
& Shankaranarayana were contemporaries. It is interesting to
note that Kulashekhara had an observatory which perhaps would be
equipped as efficiently as was possible in those days.

Divided into 8 chapters, the main work deals with the mean
lunar & lunar transits, eclipses, transits of the planets
retrograde movement & concomitant details.

Shankaranarayana's work must be deemed a highly illumin
Commentary. I would like to draw the attention of readers
an elaborate description given by Shankaranarayana of
complicated structure to be erected & appliances to be used
for the purpose of observing & measuring the shadows thrown
by the sun (pp 35-36).

A careful study of the 4th & 5th chapters of the Laghu Shas
would show occidental critics that centuries before
advent of modern occidental astronomy, the ancient Hi

Hindus had determined & understood all about the solar & lunar eclipses not merely, but had complete & perfectly accurate insight into minute & complicated astronomical phenomena particularly with the intricacies & technique of planetary transits.

A nice & subtle argument has been urged by the author Bhaskara to the effect that the movements & transits of other planets are correctly inferred from the data observationally corrected on the basis of the transits & movements of the sun. It is highly significant that Countless phenomena would have to be determined only by means of inference & inferential reasoning on the basis of fundamental data that should be observational.

While Shankaranarayana extols Aryabhatta to the skies & boldly declares that his method is the best, (This is of course the judgment first proclaimed by Bhaskara), Brahmagupta severely condemns Aryabhatta & wisely observes that it would be impossible to count or make a list of his errors.

Narayana Sarma.

pūrṇamadaḥ pūrṇamidam pūrṇāt pūrṇamudachyate
pūrṇasya pūrṇamādāya pūrṇamevāvashishyate.
'Pūrṇa divided, multiplied, subtracted from and added to Pūrṇa
yields only Pūrṇa' – thus did our ancestors who composed the
Upanishadic prayer equated God with Pūrṇa and postulated their
mathematical problems long prior to the birth of Christ. Though
Mathematics was not regarded as one of the four upavedas (Dhanur
-Veda, Ayurveda, Gandharvaveda & Arthasastra), it was the study of
Jyotisha among the Vedangas that gave a filip to this science;
Jyotisha or astronomy was like the 'eye' and was helpful to one and all and
more particularly in ascertaining auspicious moments for sacrifices.
The circular, triangular or quadrilateral figures drawn in connection
with the sacrifice again had to be taught in the Shulba Sutras
and provided the needed impetus for the growth of Geometry.
They had to observe the sky all night with instruments like
Turiya and established famous observatories in Delhi, Benares
Jaypur, Ujjain & Lanka with their (from the modern point of view beginning & equipment
Impeyect material.
They called it Science of Stars (Nakshatra Vidya) and gradually they
saddled this knowledge with that of the panchangam – tithi, Vara,
nakshatra, karana, yoga and slowly built up their astronomy.

Already in the 5th cen Be. in the list of the sciences in the Buddhist curriculum of studies according to the Buddhist scripture Mahavagga, Mathematics occupied a prominent place. Another king Kharavela in 165 Be in his stone inscription refers to Computation of interest, to calculation of daily wages for Coolies, and to the method of finding out the area of a quadrilateral. By Brahmagupta's time in the 7th cen AD, this science had not outgrown its connection with Astronomy and sometimes Mathematicians are left wondering whether Brahmagupta was a greater mathematician or an astronomer. In Brahmagupta's time, astronomy was reckoned into a separate science and Mathematics came into its own with sections on kṣetra ganita, parikarmaganita, vyavahāraganita, rajjuganita, rashiganita, kalasavarnaganita (fractions), yāvattāvad-ganita (yāvattāvat = unknown x), Varga samīkaraṇa, Arithmetic progression (mishradhana), ghanamūla = square root, indeterminate equation (aniśchitarthasamīkaraṇa) etc. Pṛthūdakasvāmi the Commentator in 9th cen included more subjects like pancha gatiya five kinds of problems, Vyasta traiyaśika (inverse rule of three), Saptarashi, ekadashavashi, Bhandapratibhāndā (barter exchange). Dhūlikarma & Pāṭīganita

were first introduced into Mathematics by Brahmagupta. Dhuli means dust, pāti signifies board; so this refers to those problems that can be worked out on the board. In Arabia these were consequently called 'ilm hisab altakht'. So gradually through the Moorish universities of Spain, these spread into Europe and Italian merchants popularised it all over Europe. ~~in spite of papal decrees~~. These are even known as leber abbacey. Brahmagupta also knew that Kuṭṭaka (algebra) can easily solve all intricate problems and Bhaskara sponsored this branch with a new name as bija or avyaktaganita. This Brahmagupta hailed as the author of two important works, Brahmagupta siddhanta and khandakhādyaka. The latter teaches easy methods for calculating the latitude & longitude of planets according to Aryabhata's 'ardharātrika method. Lanka was the Greenwich of those days & the daily movements of the planets, their position etc at Lankā at midnight are recorded. This Brahmagupta should receive properly most of the credit that Bhaskara has received and later mathematicians like Mahaviracharya and Nes unreservedly follow his lead. He has treated Geometry also fairly fully. Bhaskara might not have dealt with the

cyclic Quadrilateral but Brahmagupta has taught that the area of this cyclic quadrilateral is the square root of $(s-a)(s-b)(s-c)(s-d)$ if its 4 sides are a, b, c, d, s being half the circumference of the concerned circle. His example of arithmetic progression is worth quoting: 9 merchants jointly invest 1, 2, 3 ... up to 9 rupees and sell the same again jointly for 45 rupees. What is each merchant's share? Answer is 11, 22, ... 99. Another interesting example is a long bamboo plant is broken in the wind and falls 6 cubits away. The broken bits are 8 and 10 cubits respectively. The value of these problems is patent to everybody. This Brahmagupta solved the indeterminate equation a full 1000 years before the European solved it in 17th century as $ax^2+1 = by^2$. The value of π was mentioned as the square root of ten or 3.1416. Bhaskara and Mahavira followed him in this problem.

Mahavira flourished in the reign of Amoghavarsha Nripatunga (814 – 877 A.D.) in what is now Mysore State. His Ganitasarasangraha mentions 8 qualities as essential for a Mathematician: capacity to choose easy methods, to guess if the method can solve, diligent application, capacity for quick comprehension and retention, to work out the problem by

other means and last but not least a flair for appreciating mathematical problems.

Sir William Jones, Allston Webster, Prof Ball, Laplace and many other Orientalists have openly affirmed that these numbers are definitely of Indian origin. It is our misfortune if just because these Arabs happened to popularise them in the west, these should have become known as the Arabic numbers. Al Biruni, the Arabian historian of about 1030 called them the most beautiful form of Indian figures and declared that problems very difficult to be performed with Roman numbers are easily solved with these Indian numbers. Arabic authors refer to them as 'Al Arqamul Hindiyyah'. One can easily see how clumsy these Roman figures are: to write hundred they write C, 50 is expressed by L and 10 by X. 9 has to be written as X-I or IX. Multiplication or Division is absolutely impossible with them. These Arabians again introduced an decimals and Zero or cypher is so called because it is traced back to Arabic sifr. If Pythagoras was born in 582 B.C. the theorem known now after him was already peppounded in India in the 8th century in Baudhayana's Sautasutra. The formula πr^2

for worship and the area of a circle was already worked out in the Śatapatha Brahmana. Place value notation, or the value of a digit being increased ten times if its place was pushed back by one place say from integers to ten, or from hundred to thousand and so on was the invention of the Hindus according to Laplace who handsomely concedes that this invention places the Hindus in the most honoured ranks of the mathematicians of the world; ~~even since~~ this invention ~~according to him~~ did not emanate from the brain of the most celebrated ~~mathematicians~~ Mathematicians of Greece, Archimedes (287-212 B.C.) and Apollonius. The value of zero again in increasing the value of a number to which it is added by ten times was another invention of the Hindus. They had classified them as odd and even long before the advent of the Christian era. The fame of having carried these numbers to as many as 18 or 19 places i.e. raising 10 to the power of 18 or 19 is again another creditable achievement of the Hindus. Jains, like Mahāvīra glorified this science to the highest possible extent by declaring that Mathematics was one of the four spiritual anuyogas which would lead the spiritual aspirant to his Maker.

Aryabhata in Pataliputra, Brahmagupta and

Bhaskara in Egypt, Mahavira in Mysore and so many others in different places have earned everlasting fame by writing their mathematical poems. These poems are also highly valuable ~~[illegible]~~ satisfy the highest canons of critical dictum also. No other country in the world has treated this 'dry-as-dust' science in verse. Another speciality is that the examples they have cited are all having a direct bearing on our day-to-day problems in life. Some of them have taught the method of calculating the time of the day by measuring the number of steps in one's shadow. If they want to teach problems in square measure, the problems are those relating to building of our houses and boring of our wells or walls, their lengths, breadth and width. The problems determine the circumference of the well. Is it not our duty to study these text books written by our own ancestors who have deserved the admiration and applause of the world?

इतरजनकामहे - authorship of भोगिर्वे दशरथ

शरीरमाद्यं खलु धर्मसाधनम् -

Predictive Astrology was nurtured on the lap of ~~Hinduism~~

tickled in the breast of man.

अत्येक तोऽनुशरीरं प्रतिशयवतिनामविकृतोऽपि पुरुषकारः कर्म

अथवा दैवेन पक्रमणं न स्वस्य गतिर्भवेत्। तत्र पुरुषकारेण विना दैवं न सि

This combination between Purushakara & Daiva is the burden

Kalidasa's works and is the burden of our philosophy too.

अरक्षितं तिष्ठति दैवरक्षितं सुरक्षितं दैवहतं विनश्यति

लोके सुकृतं विपरीतता वा स्वचेष्टितानामेव नदं न यानि

Heaven waits always in readiness to reward the virtuous

of the people in the world. Mysterious are the ways of providence

Purunavas' virtue was rewarded by heaven Voluntarily dedi

itself heart and soul in devoted service. The gods in heaven are

ready to properly reward human endeavour - प्रत्यक्षमेवापकृतं सुरत्व

प्रतिपत्तिकर्तुं मनसैते समर्थाः। तथापि तत्पूर्वपदानविक्षितः स्वतः सिद्धिं न तु

but only they will put the devotion of man to a severe test and

themselves about its genuineness. Dasaratha reckoned himself as the fitt

reward for Ramachandra's sincere penance. अयोगिनं सुतमाप्तिर्हि पुत्रेष्टि

दीपादयस्त्वादृषि सिद्धयोऽपि दृष्टि ।— भारतीय इतिहासे घटयति विधेरभिमतमभिमुखं.

Though realising full well all these, the average Indian abjectly resigns himself

blindly to all powerful fate. The Ramayana epic uses the word दैव again in connection

with Rama's destiny deciders - किं चामरैः, सन्निहितो हरिणस्तवार्थे हनुमान् - last two of

उदाहरणे present.

Admirable as is Kalidasa's work, it would be unjust to ignore the fact that in his Dramas, as in his Epics, he shows no interest in the problems of life and destiny. (P.160 - Keith Sanskrit Drama)

Kalidasa and Vidhi Vilasa.

Kalidasa has been accused of not being helpful in any way in solving the problems of life and destiny by one of the greatest of the western sympathetic critics, Dr. BERRIDALE Keith. Is this criticism just? We will try to show that Kalidasa was a poet whose feet were firmly planted in the ground below him and taught humanity at large the proper way to live their life in this world fully so that we might deserve the rewards of this world and those of the next world also. The ordinary man, as a result of a misinterpretation of our Vedanta, abjectly resigns himself almost blindly to fate and links with Shakespeare's King Lear "As flies to wanton boys are we to the gods, they kill us for their sport." The burden of our literature and philosophy, as reflected in Valmiki and Kalidasa the best interpreters thereof, is to show that there must be proper coordination between life and destiny.

Man exhibits a tendency to turn fatalist all the world over. Bhattikavi narrates an interesting story of a famished and dying snake - unable even to move - which luckily could eat a mouse and move out by the way that the mouse, after having prepared for it, had in its search for food! But this fatalism deprives us of our

initiative in every way. This represents one extreme view as against which there is the Greek view of Prometheus who believes he could overcome fate and make an end of all suffering. "There is a natural fire in man which declines to accept defeat. In the fire fanned by the poet till it flames, is the secret of our delight in a tragic drama". Both these extreme views have their counterparts in Indian philosophy, and the golden mean, is the correct attitude advocated by Vedanta. The Mahabharata broke admirably sums up this view अरक्षितं तिष्ठति दैवरक्षितं सुरक्षितं दैवहतं विनश्यति। जीवत्यनाथोऽपि वने विसर्जितः कृतप्रयत्नोऽपि गृहे न जीवति। Though well-protected, a thing might perish if forsaken by God: A destitute in the forest may thrive while the best protected in the homes may succumb. To change the metaphor, divine dispensation and human effort are like the wheels of the same chariot; human progress must be secured only with the grace of divinity. When correctly understood, divinity or destiny is nothing but the manifestation of our own actions in our previous lives according to the teachings of Yājñavalkya. In other words, we make or mar our own destiny, we are the architects of our own fortunes and we have to blame ourselves

I.3.49 etc.

In the world, very often we want to appropriate the credit for ourselves if we happen to be successful, but decry fate when by some mischance our efforts go astray. The Emperor rightly if in any particular case, our plans miscarry. Sri Harsha gives a remarkable stanza in which he declares that destiny will even go out of its way to help us if we look up always to it,

दैवपादपसमाश्रयादपि मत्परादपि जनादिदं दिशो सत्यमात्

अन्यदेव ग्राह्यति विधिराशिमत्तमाशे मुखीभूतः Ratnavali I.

even from another Continent, even from the middle of an ocean, nay from even the ends of the quarters, destiny - if only ~~it is~~ made favourable - ~~destiny ships about be unites of~~ one love with another ~~quite most~~ unexpectedly ~~fast~~. The problem of Prometheus is there in every age and clime and for every person with a divine origin, actuated by humanitarian motives, he brings fire to the earth; an adverse fate dogs him ~~him~~ in the beginning but in the end he regains his freedom through his own efforts. This is also the theme and substance of our Vedanta which also declares that all men possess divine sparks and characteristics though not knowing how to make proper use of them. Shelley also teaches us to face destiny boldly and approach, though never defiantly. Man must ride and God must hold the reins. The Latin proverb nisi Dominus frustra, unless the Lord builds, there that labour build in vain, correctly understood ~~explains~~ has same truth.

Our two epics exhibit the two sides of this universal moral-Coin which never becomes incurrent with changing Government and times. With the mightiest army and the best generals of the day, Duryodhana defied fate (Karma) in its personified form as Sri Krishna had leagued Himself with the Pandavas. With monkeys and bears as his allies, Rāma managed to defeat the mightiest king with the mightiest Superman (but āsura sampat) entrenched in a most impregnable sea island fort. The Central message in Kālidāsa's works is also the same; to quote his sloka in the central act (IV act) of the Sakuntala: [illegible] Chandra the Lord of the most potent medicinal herbs, some of which can revive even dead persons, has to go to the setting mountain (or hide himself for) but imperfect, equipped the sun with a lopless charioteer and a one legged chariot rises up at the same time in the Sky! This proper Coordination between purusakara (or human effort) blessed by daiva (or fate) is suggested in every work of his Kavisārvabhauma. Heaven always waits in readiness to reward the virtuous actions of man in this world. Purūravas' Virtue was rewarded by Heaven (in Urvasi's guise) Voluntarily (Heaven typified by Urvasi) has become dignified: it must come to the earth to transform and soul in his devoted service. The gods in heaven are too to it as it is heaven

ready to properly reward human endeavour - अयमेवास्तु मदभाग्यपरिपाक Śāk VII. (but only they will put the question again to the severest test and satisfy themselves about its genuineness first. Śiva reckoned Himself as the fitting reward for Pārvati's sincere devotion - Māgha emphasised this Coordination when he declared in II 86. नालम्बते दैवहतं न निषीदति पौरुषे। ह्रीव्याधौ सात्त्विकिव हयं विद्वान् प्रेक्षते॥. Śrī Harṣa the poet also declared wisely that when destiny is averse, human effort finds itself frustrated - दैवे विमुखे यत्नो निष्फलतां याति 11.55. दृश्यन्ते प्रयासपरम्पराणि पौरुषाणि. The Aitareya Brahmana had long ago proclaimed this truth when it taught

आस्ते भग आसीनस्योर्ध्वस्तिष्ठति तिष्ठतः शेते निपद्यमानस्य चरति चरतो भगः Even philosophers might disagree sharply on all other philosophic details, but on this essential point all of them wonderfully agree. Śrī Śaṅkara in his Bhaja Govindam dedicated himself for divine service; Vedānta Deśika wisely prayed अस्य त्वत्पादपद्मे निजभरमनुकं निर्भरं निर्भयोऽस्मि and Madhva in his Dvādaśastotra advised us कुरु मुकुन्द तत्त्वं कर्म निजं निगदन्तं हरिपादमनन्यधिया सततं, to do the right thing trusting in God.

Perhaps Keith was worried by not finding any tragedy of the type of Othello or Hamlet in Sanskrit literature. The theory of transmigration and the law of karma which has become ingrained in the Indian soil for many a millennium now, preclude the possibility of the conception of such tragedies. The very conception of literature is completely different from the realistic outlook possessed in the west. Our literature has set to reflect the ideas and ideals of our religion and can never afford to slop with the contemporary world around us. Virtue or vice must have its just reward if not today in this life, at least in the next life. Our life now is the result of a past and is itself the cause of a future existence to be determined or shaped by the present. If a Hamlet were conceived or nurtured in an Indian brain, it would have completely altered the story by either introducing some Teacher to advise him properly or by rejuvenating the old Hamlet with the aid of supernatural elements. The genius of the Indian poets and dramatists lay in the fact that they managed their plots dexterously even though tragedies were forbidden: the tragic ending was carefully avoided, but the poet cleverly saw to it that the letter of the law was satisfied by eschewing tragedy and at the close, but

Human free will should be supplied with timely interference
the Divine into the affairs of humanity with a view to make
progressively better. The Gita has made it quite clear that
interference is frequent & even persistent, the agents in fact be
no other than i) the small unsuppressible voice of God with
us, ii) the lessons available to humanity in the world's rich
of experience to which we all have to submit (iii) the guid
by precept and example by the better types of men, whom the
designates as those that are carrying out God's will on earth
ways more than are. Avatara in fact is the name that Hind
piety gives to the most outstanding & unusually successfu
from amongst the Vibhutis above named.

throughout tragic situations were introduced at every stage. Who can deny that Śakuntala's repudiation in the Fact is a tragedy? The mainsprings your literature, the two immortal epics were the most heartrending tragedies, in fact the earliest and the most thoroughgoing tragedies the world has ever produced; if Kalidasa and Bhavabhuti Bana in Harsa managed to convert their tragedies into comedies with supernatural devices, Bhāsa in his Svapnavāsavadatta skilfully managed this change without the least supernatural aid.

How and why does this supernatural aid come in? Valmiki answers यदृच्छया. It may appear as though it is a really it has an inner purpose: quite fortuitous circumstance; but the Vedānta philosophy suggests the only satisfactory solution when it declares that this is but the just reward deserved by our actions in our past lives. A kind and just God waits at the corner as a disinterested sākṣi, seemingly giving every one of us a sporting chance to work our way up to Him from whose feet we have come and to whose feet again ultimately we are bound. If necessary and expedient, God even lends His helping hand our duty is to deserve and desire for His grace. in His merciful bounty; The Vedānta philosophy amply emphasises the importance of a Guru who directs our attention inward. गतिर्भर्ता प्रभुः साक्षी निवासः शरणं सुहृत्. Such Gurus

Visvamitras or friends of humanity are there always and we will be fortunate if we recognise them. But their ways are mysterious and there is no knowing when they will come. Rama in the Ramayana meets with 2 of them Visvamitra and Hanuman at most critical moments and derives the utmost benefit from them. But evil geniuses with wonderful potentialities for mischief also cross our path, as यद्दृच्छया or most unexpectedly too also; Mantharā and Surpanakhā do so and all these four, it is interesting to note, cross Rama's path यद्दृच्छया. Vālmiki uses the word यद्दृच्छया As regards the second instance, in connection with these 2 personalities. Murāri in his Anargharāghava declares यानि तिर्यग्योनिष्वपि सहायतां उपयातानि तु रामस्य सोदरोऽपि विमुखतामिति; that even beings of the sub-human species come to the aid of a righteous person (Rama); even the brother (Vibhisana) deserts the person (Ravana) treading the unrighteous path.

Kālidāsa refers to such Visvamitras who unbidden come to the rescue of forsaken humanity. Kanva rescues the baby forsaken by her parents and protected by Sakunta birds. Vālmiki hears the cry of Sita in despair and protects her just as his heart had melted in sympathy with the bird shot by the nisāda. Amongst divine, Kanva is the

Śākuntala I act cannot divine exactly how adverse destiny will overtake her and land her in peril. He was away on pilgrimage to avert her दुर्दैव, but दैव chose that very occasion to throw her into Duṣyanta's arms. Fortunately the अतिथि fell into the विधि though the यजमान was [illegible] दृष्टि; but before he यजमान could return, before even Duṣyanta could reach his Capital in 1½ days' time, the man of evil destiny Durvasas crossed her path and he order to escort her to the palace was not even uttered and Śakuntala was clean forgotten. To add to her cup of misery, Kaṇva happened to return on a Pūrṇimā night. The next morning on which he sent her to her husband's, happened to be the first day (प्रतिपत्) in the dark fortnight, most inauspicious for starting on a journey and she was unwittingly sent to her doom. But fortunately for her, in a most mysterious way, the lost ring was swallowed by a fish and a fisherman's research unexpectedly came to her rescue. She was remembered but Duṣyanta was at his wits' end and he cursed himself for having driven Śakuntala to her destruction. But the most pleasant surprise awaits him; he is lifted up to heaven to be reunited with his child and wife!

Trust in God, tread the righteous path and allow her guiding light to be your guide. Never neglect your legitimate duties- [illegible] All will be well with you— This is the moral of our literature and philosophy.

Bernier (1616-1668) mentions the method by which poison can be conveyed in a betel chew. A young nobleman by name Nazeran was suspected by the Mogul of an illicit love affair. As a mark of distinguished favour the King presented the betel in the presence of the whole court, to the unsuspecting youth, which he was obliged immediately to masticate, agreeably to the custom of the country. Little did the unhappy lover imagine that he had received poison from the hand of the smiling monarch, but indulging in dreams of future bliss, he withdrew from the palace, and ascended his palanky. Scarcely however was he seated in it, than he died before he could reach home.

Suśruta (सुश्रुत संहिता) - to control phlegm which increases after the intelligent eater should partake fruits for an astringent, pungent or bitter taste or by chewing a betel-leaf prepared with broken areca camphor, nutmeg, clove etc or by smelling. वराहमिहिर बृहत् संहिता ८१.५ ताम्बूलगंधयुक्ति - कामं प्रदीपयति रूपमिव्यनक्ति सौभाग्यमावहति वक्त्र सुगन्धि तांबूल। हर्षं करोति कफजान्क्षिपति हृतिं रोगान् ताम्बूल मेवमपरांश्च पुनाति करोति॥ युक्तेन पूगेन करोति रागं रसाढ्यं पूगफलप्रसिद्धि क्रमम्। पूर्णाधिकं वक्त्रकृतिं करोति पत्राधिकं सारु करोति गन्धम्॥ पत्राधिकं तिक्तं हृतं सपूगं दिवौषधं प्रोक्तमग्नि करणमस्य विद्यात्। कर्पूरपूगं तु चली फलं परिजातैश्च मोदितं मदनसुखदामुदितं करोति॥. Alberuni says 'the power of digestion is so weak that he must chew betel after dinner & chewing betel nut. The hot betel leaf dissolves wet & makes acts as an astringent on the teeth, refreshes the stomach. (India ch-68-p-152

Gardiner says that arecanut corrects the bitterness of betel leaf & chunam prevent it from irritating the stomach. United these nuts are extremely wholesome, nutritious & enduring quality.

ಹುಂಬ ಚಪ್ಪೀಲಿಯ ಅಗಿ ಕಾಳಪಪ್ಪೀಲಿಯುಲು.

ವಮ್ಮ ಪೌಗಾಲಾಕಾಳಪಪ್ಪಿಲಿ ಉಲ್ಪೋಪ್ಪೆ ಪ್ರಿಯುಗಾಗಿ ಆಹ್ವಾಲ್ಲೆ ಕಾಳಪಿಯ ಪ್ಪೀಲಿ ಆದರಿಸುವರು. ಉತ್ತಮ ಮಹಮ್ಮದೀಯರು ಹುಂಬಕಾಳಪಪ್ಪಿಲಿಯಂಕೆ ಇರುವರು, ಬಿಲವು ಕಾಳಪಪ್ಪೀಲಿಯು ಅತಿಶೀತವಾಗಿರುವರೆಂದು ನೊಣವಾಗಿ ಕಿತ್ತಿಸುವರು. ಉತ್ತಮ ಮನುಷ್ಯರಿಗೆ ಆದರ್ಶಭೂತನಾದ ಪರಮಾತ್ಮನೇ ಯೋಗಿಗರ್ಭವಾಸನಂಬ ನಕೇಲವರದಳ್ಳಿ ರಾತ್ರಿಯನ್ನು ಹುಂಬನೆಂದು ಅನೇಕತೆಡೆಗಳಲ್ಲಿ ಉಲ್ಪೋಪ್ಪೆನ್ನಿ ಪರಮಾತ್ಮನನ್ನೇ ಹುಂಬನೆಯು ವಿದ್ವಾಂಸರುವರು. ಬಿಲರನ್ನೋ ಕಾಳಪಪ್ಪಿಲಿಯ ಕಾಲನವರ್ಣಗಳಿಸೀ ಹೊಲಿಲಂನಿ, ಪರಮಾತ್ಮನನ್ನು ಕಾಲಾಯುದಮುಖಾಧಿಕ ಮುಖಾತ್ಮನೆಂದು ಹೊಗಳುವರು. ಇನ್ನು ವಮುರ್ಖಾಯುದ ಪರಮಾತ್ಮನನ್ನು ಹುಂಬಕಿಂಚುಕರಿಯುವರು. ಈ ಹುಂಬಕ್ಕೇನೆ ಕಾಲನ್ನು ನೀರನ್ನು ಬೆರೆಸಿದಿಗ, ಕಾಲನ್ನು ಸ್ಥಾನಕ್ಕೆ ಎಳೆದುಕೊಂಡು ನೀರನ್ನೆ ಬಿಟ್ಟು ಬಾಹುವರು ಉತ್ತಮವಾದಗುಣವನ್ನು ತಲ್ಲಾಸಿ ಉತ್ತಮರಾಜನರು ಇದರಂತೆಯೇ ನಮ್ಮಲಿ ಗರ್ಭವೇ ಪ್ರತಿನಿಮಿಷಕ್ಕೂ ದುಷ್ಟೋಪಾಸುವರು.

or whether it is the result of seeds planted, or accidentally left, a
natives who have long since departed from the region in questio
bearing no trace of their former presence. There in the Philippine Isl
is a variety of Areca catechu known as silvatica as well as several
other varieties, which has led botanists to think that the wild plant
originated here. 'Any species of areca is not to be found in Southern
or Eastern Asia or Malaya which in any way approaches Areca Catech
in specific characters, whereas in the Philippines an entire group
of species closely related to it exists.' - Beccari - Palms of the Philip
pine islands, Philippine Journal Science Vol XIV p. 301. Mr Merrill
says 'Here itself a lake'. At the place where found the plants grew in small
were growing in a forested ravine alongside a small stream at a place
where an old & apparently much travelled native trail crosses
the stream. I strongly suspect that the trees found in Mapher
originated from seeds accidentally left there by natives.' N.M.
Berger is tempted to believe that if this custom did not originate
on the coasts of Southern India, it was imported from the Eastern
Archipelago at a very early date. Prior to about 200 B.C, betel is
the Jātakas & in several Pāli works (Buddhaghosa's Visuddhimagga
314, & Dhammapadaṭṭhakathā VII XXX. p 48) as well as in the

Jaina scriptures Aupapātika Sūtra section 38), this habit of betel chewing is referred to. The [illegible] is an important functionary in royal courts & is referred to even in inscriptions-Epigraphica Indica VII xi p 329 etc. Hitopadesa Book III stat ix & xii. tells that it possesses 13 qualities hardly to be found in the regions of heaven. It is described as pungent, bitter, spicy, sweet, appetising wind, removing phlegm, killing worms, & subduing bad smells. It beautifies the mouth, removes impurities, & increases love. Suśruta mentions it in the 1st Cen. A.D. In chap xlvi in a section on digestion he says that the intelligent eater should partake of some fruit of an astringent, pungent or bitter taste, or chew a betel leaf prepared with broken arecanuts, camphor, nutmeg, clove etc. By Kuvadevi's time the custom was so common that reference to it was practically given up. Abd Allah ibn Ahmad (1225) refers to the leaves being preserved in honey. He says Indians use it after their meal (instead of wine) to brighten their minds & drive away their cares. Marco Polo (1295 A.D) refers to a strange custom in which if anybody wishes to offer a gross insult to another, when he meets him he spits the leaf or its juice in his face. After this the other immediately before the king, relates the insult, and demands leave to fight him. The king supplies the arms, the sword & the target, and all the people flock to see & the two fight till one of them is killed. The use of the point of the sword is forbidden by the king.

camphor was a wrong translation for quicklime. Garcia
orta says' In Chaul betre they mix areca with it and
lime. Some add dicio (= catechu) but the rich & the grand
add some Borneo Camphor & some Cipr-aloes, musk an
ambergris." Yule correctly quotes Abul Fazl (1596) as sta
that Camphor is an ingredient of pānsupāri. पानसुपारी is
the Bombay Vernacular Piper chaba Cammaraj Kuruma
Bakek. Ridley says it can be used as a substitute fo
betel leaves during famines if fresh leaves may not b
procurable. लवंग is cravo, caryophyllus aromatic
Jātiphala is nutmeg & सुपारी is coarse arecanut -
Others mention these five as (1) Cutch = extract of Cate
- Hindustani Kat, Kath, Sanskrit कत्थ. (2) चूना-lime =
3) सुपारी (4) Lavanga (5) Elāchi इलायची.
The Singhalese chew the rhizomes of A. masticatorius
with their betel.

The geographical area covered by this custom
lies between longitude 60° & 170° east & latitude 40° nor
and 15° South. It includes India, Pakistan, Southern Tibe
Southern China, Siam, Indo-china, Malaya, all the E

Indian Archipelago, Micronesia, New Guinea, and the remainder of Melanesia as far as the tiny island of Tikopia. It is just about here that one can observe the drinking of Kawa taking the place of betel chewing. In both Polynesia & Australia pān supāri can be regarded as unknown. Although arecanuts have been exported to Fiji, & possibly to other islands, betel chewing rarely occurs in kawa-drinking areas.

It is impossible to say where this custom originated. Etymological evidence seems to favour an Austroasiatic, rather than an Indo Aryan home. Perhaps we should look for its origin in the Philippines, Celebes, Borneo, Java or Sumātra. Botanical evidence is very noncommittal and uncertain, owing largely to the length of time the Areca Catechu & Piper Betle have been cultivated in the East. The former has been described as a native of Cambodia and Indonesia & as being cultivated in the East. The latter has been described in Watt (op. cit VII vi, pt 1, p 248) as probably a 'native of Java'. The evidence for such statements seems to be distinctly weak. The problem is increased by the fact that it is often hard to determine whether a certain tree or a shrub is really 'native'

have been derived. Tamil pākku Telugu pōka · Vakka or poṇ
Vakka; Singhalese puvak or puvakka; Gujerati phophal
leads to Persian & Baluchistan pōpal & Arabic fanfal, fōfal,
The word areca is to be traced to Kannada aḍake or aḍike or
aḍakka or aḍekka.

Pān is the leaf and supāri is met in Hindi and other North
Vernaculars. the latter sometimes changes into supyāri, sopāri,
hopāri etc. With regard to Piper betle, tāmbūla or nāgavalli
in the Vernaculars. The more usual term is pān from which
pann = leaf is derived. Malayalam Vettila (Verm + ila = simple
is also used. In Hindustani, we find pān & tāmbūla, in Bengali pā
in Marathi vide-chā-pān; in Gujarati pān, nāgller-Vel; in Do
pān; in Tamil vettilai. Arabic tambūl, Persian tambōl, tam
the portuguese formed derivatives of Vettila which became
and betle. From this the English betel is traced - 16th cen spelli
betola, bettle, and betele; 17th cen spelling betele, betell, bet
betre, bettaile, bettle, and betel; 18th & 19th Centuries betle, beet
betelle & betel. In tāmbūla, vostrand is būla with tam as a pr
Przyluski has shown that būla corresponds to the Austroasia
(non Indo Aryan) bāla = something rolled; all Austro Asiati

languages use such words as bala, mlecc, bōlōn, mēlu, blu, plu, to mean betel. Some have a prefix such as la-mlu, ja-blu. In modern times, it is only the direct Sanskrit derivatives that keep the prefix.

Somadeva speaks of the five fruits flavouring arecanut, or bale of leaves of betel together with Camphor & the five fruits. The best list is arecanut, cloves, lign. aloes, ambergris and catechu. Of these only the first could possibly be called a fruit, — cloves are only flowerbuds. Lign aloes seems to have been used very rarely, while ambergris would have been entirely restricted to the rich. We must allow fruit to include every kind of Specie or flavour. Vaidyaka Sabda sindhu, a Hindu medical dictionary under the word पञ्चसौगन्धिक used in betel chewing mentions them as क्पूर (2) कङ्कोल (3) लवङ्ग, जायफल, पूग. क्पूर is also referred to as चन्द्र भस्म, referring to its moonlike coolness. It has corrupted into कापूर, कप्पूर, and are traceable to the Sumatran Camphortree, gālū or qāmbū whence Indian supplies were derived. Marco Polo mentions camphor & other aromatic spices in connection with betel chewing. Marsden expressed his opinion that

Tambūla.

The comparative lack of interest which this custom has stimulated in the west is really surprising. Over a 100 millions of the human race, but entirely in India and Farther India, Malaya and Indonesia, have taken to this as a daily, hourly & even more frequent habit! From his marriage or even far earlier to his grave, even to accompany him in the next world, this leaf does devoted service.

The seed of the areca catechu is used alone with the expressions betel nut or betel nut palm are incorrect. Tāmbūlam is the chew of this nut with a pinch of lime wra round by the leaf. In Sanskrit the usual word for this leaf tāmbūla, but if the leaf is particularly mentioned the wo nāgavalli is employed especially by Somadeva. He uses the word in all cases except in the context in which Yasastilaka son (Madirāvati Book XIII Chap IV) where nāgavalli mea leaves of the betel & 2 or 3 lines later tāmbūla is the chew whi young Brahman puts in his mouth. The usual Sanskrit for the nut - pūgaphalam & guvāka - do not occur in K sambāpana at all. It is from the former of these that the Ka